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The Outlook

Another Evacuation

THE numbers of the British forces in Greece which have been successfully evacuated give cause for delighted surprise. Details of how this second miracle was accomplished will be made known in time, but for the moment one can only marvel and offer up thanks. The conditions were very different from those of Dunkerque, for the sea crossing was longer, and there was no reserve of fighters such as the Fighter Command could and did supply at Dunkerque to hold off the German bombers. In Greece the shortage of fighters was one of the worst British handicaps, and what Hurricane squadrons we had there were gravely handicapped through the overrunning of their aerodromes by the German advance. The Germans had loudly proclaimed their determination that there should not be "another Dunkerque," and orders to that effect were issued to their bombers. Despite all that, over three-quarters of the Empire forces got safely away.

There is probably some lesson to be learnt and some moral to be drawn from this incident, but until all the facts are known it would be futile to search for it. One is inclined to ask whether the Junkers dive-bombers always become ineffective when they are required to act on their own instead of as the advance guard of a Panzer division, but one can see no reason why they should fail when not adequately opposed by fighters. We must wait for enlightenment.

Of necessity the Empire forces must have lost many tanks, other vehicles and guns, material which can be ill spared by the Army of the Nile. The possibility of losing it must have been faced when the decision was taken to land troops in support of Greece. But most of the men have been saved, and they are men of great skill and experience in armoured warfare and in desert tactics. Their skill will be useful again when they get new equipment.

It cannot have been possible for us with our limited resources to take away many Greek troops to Crete, and it is tragic in the extreme to think of these amazing heroes becoming prisoners in German hands. Up to the very bitter end Greece has maintained her reputation for chivalry as well as for courage. History has little to record of a finer spirit than the Greek note which set the Empire forces free from their engagements and advised their withdrawal. Greece will deserve the highest rewards when the final day of reckoning dawns.

Pertinent Questions

A TURKISH writer who is very friendly to the cause of Britain and her Allies, M. Yalcin by name, finds it hard to understand why the British have not yet bombed the Rumanian oilfields, why the *Scharnhorst* and *Gneisenau* have not been sunk or permanently disabled after a dozen bombing raids on Brest, and why the Royal Navy and R.A.F. did not prevent the Germans from landing a large force with tanks and vehicles in Tripoli. It is natural that these questions should be puzzling to an Ally.

Experts have written to the papers to point out that an actual oil well is a small target which it would hardly be worth while trying to hit at night. Oil storage tanks are a much more profitable objective, and probably M. Yalcin's question includes them. It might be added that it is surprising how, after eighteen months of war, the R.A.F. still has to make repeated attacks on the oil stores at Rotterdam. Rumania is much more remote, and while land campaigns were in progress the Middle

East probably had not a sufficient supply of heavy bombers to obliterate the Rumanian fields.

As for the battle cruisers at Brest, it cannot be said that they have *not* been permanently damaged by R.A.F. bombs. One has certainly had a direct hit, but the way in which this news was given out, in a citation for the award of a D.F.C., was strange, and may well have escaped the notice of M. Yalcin. It has been admitted that our Generals were taken by surprise at the strength of the forces which the Germans succeeded in landing at Tripoli, but in all likelihood only the Admiralty could give the true explanation of what happened. Certainly the chief task of the Navy at that time was to escort the transports for Greece.

New Minister for Aircraft Production

LAST Friday's official announcement of changes in the Government probably came as a complete surprise to the general public, although the Press had been aware for some little time that they were likely to occur. The retiring Minister for Aircraft Production has certainly left his mark on the entire industry, and the nation owes Lord Beaverbrook much for the way in which, particularly when he first took up office, he cut through a lot of red tape and by his energy got things moving quicker. He certainly made two aircraft grow where one grew before, and he made many grow where none grew before. That this was not achieved entirely without friction is scarcely surprising. When the clutch is let in suddenly and hard, the transmission is likely to be somewhat strained, but the mechanism stood the shock, and the vehicle accelerated into second and third gear in record time. It cannot yet be claimed to have got into top. There is one thing for which the aircraft industry has in particular to thank Lord Beaverbrook: he obtained for it a priority in the matter of materials which was of incalculable value.

The new Minister for Aircraft Production, fresh from the office of Minister of Transport, is an old friend of the British aviation world. That Lt.-Col. Moore-Brabazon holds the first aviator's certificate to be granted by the Royal Aero Club will be known to most of our readers. What the younger generation may not know is that he was a "frontispiece" in the very first issue of *Flight*, published on January 2nd, 1909, thus being the first pictorial subject on the first page of our first number. He has not been directly connected with aviation during the entire period since then, but he has always kept in close touch, largely through the Royal Aeronautical Society, of which body he was president for several years. Fifty-seven years young, virile and energetic, he starts with one disadvantage not shared by his predecessor: he knows enough of the technical aspects of aircraft production to appreciate the industry's difficulties; because of that, he may not be so good at demanding the impossible!

KITE BALLOONS AND CROW'S-NESTS: Ships in convoy now tow special kite balloons to impede the dive bomber and deck strafer.

War in the Air

End of the Greek Campaign : The Evacuation : Finishing in Abyssinia : The Bombing Business

SHIP OF THE DESERT : A Vickers Wellesley flying over the countryside near Keren. The "floats" are bomb containers. It was the flight by three of these machines from Egypt to Australia which brought the world's long distance record to Britain.

AS was to be expected, the Germans occupied Athens after forcing their way past the British and Australians at Lamos, near Thermopylæ. It is strange how history repeats itself. In the Persian invasion of Greece in 480 B.C. the Spartan strategists decided that there were only two points on land at which a stand could be made, namely, Thermopylæ and the Isthmus of Corinth. Athens and Attica were held to be indefensible, and were evacuated by the inhabitants. In 1941 the Germans evidently realised the possibilities of the Isthmus, and they hastened to drop parachute troops behind it in the Peloponese, a manœuvre which was not within the powers of the Persian General Mardonius. But in the end Mardonius and the flower of his army were exterminated at the battle of Platæa, and we have no doubt that the final fate of the German invaders will not be very different. In their short campaign they have lost very heavily, and have learnt that to fight with men of the British Empire is a desperate business.

Some correspondents have been writing that the superiority of the Germans in the air was the determining factor in the campaign. These writers are not necessarily correct. To be vastly superior in one arm is always a great advantage to any army, but it does not invariably mean victory by itself. The words of Gen. Sir Thomas Blamey, "We have learned how very inaccurate aerial bombing is," do not bear out the view that the *Luftwaffe* was the main instrument of German success. It is equally likely that the superiority of the invaders in tanks was the main reason for their rapid victory. The Greek Army of the Epirus is said to have been very short of anti-tank guns, and that, combined with the turning of its flank by a German column, would be enough to account for its surrender. When the Allied left flank had thus been put out of action, the chances of holding the line became negligible.

It is a matter for great thankfulness that such a large proportion of the Empire forces was successfully extricated, despite the efforts of the German bombers and the shortage of British fighters. Apart from our rejoicing that British lives (including those from the Dominions) were saved, these men were particularly valuable to the Allied war effort because of the experience they had amassed, and this applies particularly to the men of the armoured division. They had to leave their tanks, vehicles and guns behind, but they brought away with them their skill, and in time they will use it in other vehicles. General Wavell will be very glad to have all of them back, for it looks as if the Mediterranean war will soon be developing on new lines.

In North Africa

THE capture of Dessie by the South Africans and their Air Force was a great feat of arms, and is a considerable set-off to the failure to save Greece. The Italians had hoped to hold the place for at least three months, but the South Africans took it in 10 days, and in it captured some 8,000 prisoners, of whom 5,500 were Italians. The victors set free some R.A.F. and S.A.A.F. pilots and crews who had fallen into the hands of the enemy. The aerodrome at Komboltcha, in the valley below the town, had been reduced to rubble by the S.A. bombers, and 22 skeletons of burnt Italian aircraft were found among the ruins.

Only one Savoia bomber remained available, and in it the Duke of Aosta, the Viceroy of Italian Africa, flew off from Dessie in the direction of Amba Alagi. One may admire his tenacity, and his desire that the British shall not yet have the satisfaction of capturing a Viceroy of the King of Italy and (late) Emperor of Ethiopia, but one cannot see what good he will do by escaping without any troops. Most probably an uncomfortable time lies before him, unless that Savoia can contrive to get him away to his native land. If he falls into our hands, he will certainly be treated with all consideration and be made as comfortable as any prisoner of war could desire. His record as Viceroy has not been stained by any of the atrocities such as have made the name of Graziani loathsome to all Africans.

In the western desert the R.A.F. and the mobile columns have been busy in hampering the enemy at every opportunity. One day towards the end of April a machine out on reconnaissance shot up seven Ju 52 troop-carriers on the ground. The Canadian officer who was captain of the machine gave the following account of the incident: "We had completed our recco and were coming back over Benina, when we were confronted by the sight of what looked like a hundred Ju 52's lined up wing tip to wing tip. It was too good to miss, but it is not our job

WAR IN THE AIR (Continued)

to attack so I called up the crew and asked them what they thought about it. 'Let's wreck 'em, sir,' they said. So from about two and a half miles up in the air I pointed the nose down into a steep dive. It looked as if the Junkers had just landed, for there were groups of soldiers gathered about on the landing ground. We dived right down to about fifty feet, and flashed right along the line of German aircraft giving them all we had. One of the aircraft burst into flames immediately, and smoke poured from others. The soldiers were too startled apparently to raise their rifles They just closed up like penknives and toppled to the ground. As we mowed through them at the bottom of our dive, the belly of our aircraft must have been almost skimming the ground. My observer told me afterwards that we had done a good job. My other gunner fired a burst into a CR 42 which was standing away from the line of German aircraft." The R.A.F. pilot returned safely to his base without a single casualty or a scratch on the aircraft.

The Battle of the Atlantic

MEANWHILE, the Battle of the Atlantic and the activities of the rival bomber forces on the Northern front continue. Little is published of what happens in the Atlantic, but the United States is steadily taking a more active part in helping the British effort. The *Luftwaffe* in the latter part of April largely desisted from widespread bombing of residential areas, and concentrated its attention on British ports, chiefly Plymouth and Portsmouth. Those towns suffered severely, and doubtless the German intention is to hamper their utility to the British naval and marine activities in the war. That action may fairly be called a strategic use of bomber aircraft. Ports along the East coast of Britain have also suffered occasional raids.

The Bomber and Coastal Commands have likewise increased their activities, and the latter force has been taking a regular toll of German shipping all along the shores of enemy-occupied territory from Norway to France. It cannot be said whether this coast-wise shipping has increased much of late, or whether the Coastal machines have been able to pay more attention to it since receiving more aircraft. The torpedo has occasionally been used by the Beauforts, but the bomb has been the chief weapon. Great daring has been displayed by the air crews in pressing home their bombing attacks, and the number of hits scored by the bombs has been very satisfactory. Naturally, the small supply ships do not move very fast, and make fairly easy targets, but escorting destroyers and *flak* ships have also been hit, and they are much more elusive marks. Naturally, there have been losses to British aircraft, for the pilots have come down low, knowing that much is at stake, and that the safety of their country depends to no small extent on their efforts to harry the German preparations, whatever the latter may be preparing to do.

Some specific instances of our daylight raiding may be quoted. Blenheims of the Coastal Command sighted two enemy destroyers escorting supply ships off the Dutch coast one morning. Defying a heavy storm of anti-aircraft fire, our bombers pressed home their attack from a very low altitude and their bombs were seen to strike home. Later, one of the enemy warships was seen spouting a great volume of smoke and came to a standstill. In this gallant attack four of our aircraft were lost.

A number of aircraft of Bomber Command were also engaged in widespread operations the same day. A Stirling raided Emden, dropping a number of heavy bombs and raking the docks with machine-gun fire from 1,500ft. The bomber returned safely. Shipping was also attacked at several points off the coast of France and Holland, vessels of 2,000 and 1,500 tons being hit and believed sunk. Bombs were dropped on a factory and railway yard at Meppel, near the Zuyder Zee and other targets were Den Helder docks and De Kooy aerodrome. One aircraft of Bomber Command was lost.

The Battle Cruisers at Brest

SERGEANT KEITH IAN STREET, of the Royal New Zealand Air Force, who has just been awarded the D.F.M. for his part in a recent raid on the two enemy battle cruisers at Brest, is 25 years of age. After training he came to England and has taken part in numerous operational flights, including raids on Berlin and Leipzig. In describing this raid on the German warships, he said: "Altogether I have made eight trips to Brest. On this occasion we dived down to a thousand feet to drop our bombs. We got a direct hit. There was very severe anti-aircraft fire coming up almost directly underneath us, and also from either side of the canal. They were strafing us fiercely. Here were also many searchlights, and we got held in a cone. The only thing to do was to try to put them out of action, so I opened fire. Then one of the pins which fix the guns came out, and I was left holding the guns idly in my hands. I looked around for something suitable with which to make a repair, and seizing a thin piece of steel, about the size of a pencil, from a flame float, managed to stick it in the hole where the pin had been. I then resumed firing at the searchlights. At last we got clear. It had been rather hot, but I enjoyed every minute of it. The captain did a fine job in bringing us safely home."

The Havoc has been in action. Our readers are doubtless aware that this name signifies the night-fighter version of the Boston, which itself is the R.A.F. name for the Douglas

ANGLO-DANISH PROTECTION: British Army officers going ashore in Iceland after arrival by the Short Sunderland in the background.

ENEMY AIR LOSSES TO MAY 3rd

		Over G.B.	Over Europe	Middle East
April	27	1	—	—
"	28	4	1	2
"	29	7	1	3
"	30	—	—	1
May	1	1	—	3
"	2	4	1	3
"	3	16	1	4
		33	4	16

Total in Northern Area: 4,483. Middle East, about 1,452.
(Further returns from the Middle East may be issued).

DB 7. One night recently Havocs carried out successful attacks on three enemy aerodromes in Northern France from which German raiders set out to attack this country. Enemy aircraft were bombed while landing, aerodrome installations were attacked with incendiary bombs, and a German fighter-bomber which sought to engage one of the Havocs was itself shot down.

At one of the aerodromes attacked, the crew of a Havoc surprised a number of enemy aircraft, some with navigation lights on and others with headlights, which were landing in quick succession down an illuminated flare-path. Coming down to a low level, the Havoc dropped a stick of high explosives and incendiary bombs which was seen to burst across the aerodrome just as three enemy aircraft were about to land, and two others were taxi-ing across the landing ground. All lights on the aerodrome and on the enemy aircraft were immediately extinguished, and the ground defence guns and searchlights came into action. The plane remained circling in the vicinity until the fire had burnt out, and then returned to its base.

British night defences are certainly getting into their stride. In April no fewer than 89 German bombers were destroyed, some by fighters and some by A.A. fire. The month of May also started well, and in the first three nights 22 enemy aircraft were destroyed. Saturday, May 3, when the heaviest raid was on Liverpool, the defences did particularly well. Helped by a bright moon, the fighters shot down 13 machines, the A.A. added two more, while a sixteenth German ran into the cable of a barrage balloon. It has become a regular practice for some of our night fighters to visit the aerodromes in France and wait for returning raiders. It has proved a very profitable business and the number of raiders destroyed has rewarded the enterprise of the daring British pilots. It is certainly not calculated to cheer the spirits of German air crews to know that when they turn their noses for home they have not left all danger behind.

WAR IN THE AIR (Continued)

While on the subject of enemy air losses, it may be added that in April 250 enemy aircraft were destroyed in the area covered by the Middle East Command. In the western desert, where numbers of German machines have appeared in support of the Italians, Empire fighters shot down 81, A.A. fire accounted for 11, while 31 were destroyed on the ground. In Greece and Albania our fighters scored 55 and the A.A. guns another 10 during the month, while over Malta fighters secured eight and the guns two. The Middle East fighter pilots include South Africans and Rhodesians as well as Free French.

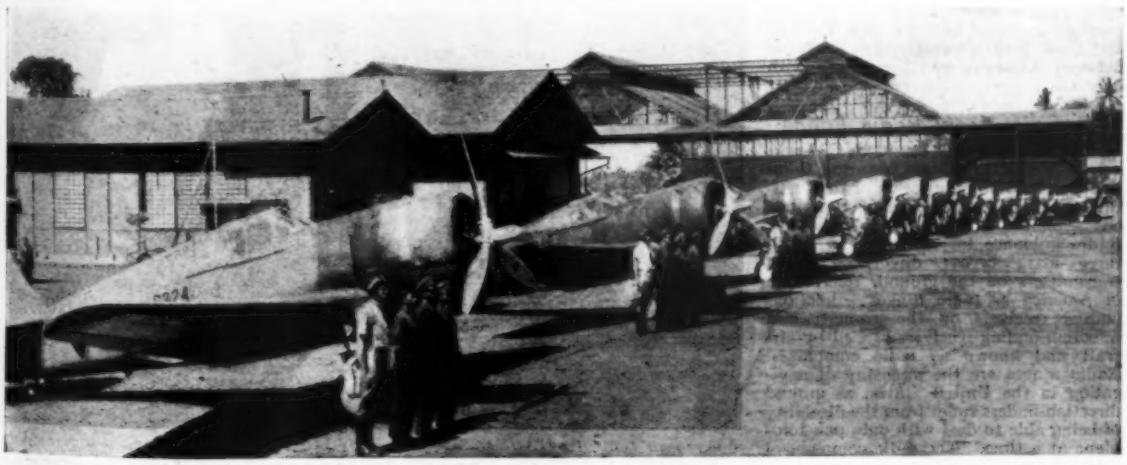
The Revolt in Iraq

A CONTEST which, on our side, is almost purely aerial, has followed the revolution brought about in Iraq by the pro-German Rashid Ali. His troops, as everyone will have read in the daily papers, surrounded the British station of Habbaniyah, on the Euphrates, and opened artillery fire on it. The women and children had already been evacuated by air. It was stated some months ago that the Command known as British Forces in Iraq had been placed under the Middle East Command, and it is reasonable to suppose that, while Iraq appeared quiet and friendly, some of the squadrons had been withdrawn by Sir Arthur Longmore for service elsewhere. In recent messages Habbaniyah has been described as mainly a training station. However, the machines available proceeded to bomb the Iraqi guns, and silenced many of them. Some units of the Iraqi Flying Corps (which is a branch of the Army) tried to bomb the British station, but were driven off by the R.A.F. machines. R.A.F. bombers raided the aerodrome outside Baghdad. There was also an action at Basra. Numbers of Iraqi flying officers have been attached to R.A.F. squadrons in Great Britain for training and have made themselves very popular. It can hardly be believed that such men would willingly fight against the British. The Arab world in general is strongly anti-German and pro-British. The Regent of Iraq, who had fled before the revolt of Rashid Ali, called upon the nation to rally round him and be loyal to the treaty with Great Britain.

BRITISH AIR LOSSES TO MAY 3rd

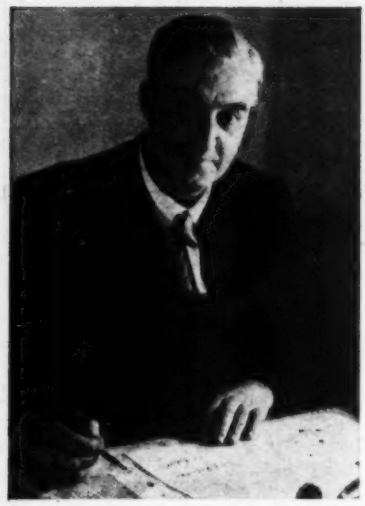
		Over G.B.		Over Europe and the sea	Middle East
		Aircraft	Pilots	Aircraft	Aircraft
April	27	—	—	—	—
"	28	—	—	2	1
"	29	—	—	4	4
"	30	—	—	1	—
May	1	—	—	1	3
"	2	—	—	4	1
"	3	—	—	2	1
		0	0	14	10

Total in Northern Area: 1,909. Middle East, about 192.
(Further returns from the Middle East may be issued.)



HAWKS FOR THE FLYING DUTCHMEN—The Royal Netherlands East Indies Air Force is being equipped with Curtis Hawk 75A single-seater fighters and here is seen the first batch of these highly manœuvrable aircraft lined up at the air base at Bandoeng, Java. They are similar to the American-built Curtiss Mohawks supplied to the R.A.F.

HERE AND THERE



Mr. C. P. Robertson, O.B.E., now appointed Deputy Director of Public Relations, will continue to be responsible for Press and Publicity arrangements at the Air Ministry.

D.A.S.R.S.

A NEW joint Air Ministry and Admiralty directorate has been set up to deal with and co-ordinate the services already in existence for rescuing the crews of aircraft and ships. The new directorate bears the title Directorate of Air/Sea Rescue Services, and the first director is Air Commodore L. G. le B. Croke, R.A.F. Capt. C. L. Howe, R.N., is deputy director.

Over Oceans and Continents

THE Pan American Airways route across the Pacific to New Zealand from the United States joins San Francisco, Los Angeles, Honolulu, Canton Island, Noumea and Auckland. The journey across the States to New York can be accomplished in four hops, with stops at Salt Lake City, Cheyenne, Omaha and Chicago. So it is now possible to travel between New Zealand and New York with only nine stops, or between Australia and New York with only ten.

Omni-directional Radio Range

A PAPER given by David G. C. Luck, of the R.C.A. Manufacturing Company, at the annual meeting of the Institute of Aeronautical Sciences described an "omni-directional radio range." Radio guidance for aircraft may be of three main types: directional beam transmitters on the ground, referred to in America as radio ranges; direction-finding receivers on the ground; and direction-finding receivers carried by aircraft and known as radio compasses. Radio ranges are the mainstay of navigation in the United States, as ground direction-finders suffer from the disability of being able to deal with only one aeroplane at a time. The radio compass, of necessity not as elaborate as the ground d.f. station because it has to be light and of small volume, yields results of not such an accurate character.

The R.C.A. type of ground transmitter supplies to each aircraft tuned to it a direct indication of its bearing from that transmitter and this is done automatically and continuously. It is also possible for the aircraft to be given a magnified indication of its deviation from any chosen azimuth. These indications are independent of the aircraft's heading, and any number of aircraft may be served at once with no transmission from them to cause interference or reveal their position. The system works on ultra-high frequency and only requires normally good receiving equipment aboard the aircraft.

John G. Winant

LITTLE has been heard of the past performances of Mr. John G. Winant, U.S. Ambassador to this country, and it will come as a surprise to many to know that he was an airman during the last war. Enlisting in Paris in 1917, he was commissioned in January, 1918, as a First Lieutenant, and later was promoted to Captain in the U.S. Air Service, in command of the 8th Aero Squadron. He returned to the States early in 1919.

Quantas Empire Pilot

QANTAS EMPIRE AIRWAYS has several of its flying-boat captains with flying time totalling over ten thousand hours. Capt. R. S. Adair is one of them, having started his flying with No. 1 Squadron of the Australian Flying Corps in 1915 and rising to the rank of Flight Lieutenant. After the war he "barnstormed" round Australia with an Avro 504K and obtained several ground engineer's licences, later founding the company Aircrafts Pty. Ltd., which still operates in the district out from Brisbane. The year 1927 took him to the United States, and then in 1936 he joined Qantas to fly DH86s between Brisbane and Singapore. He became a flying-boat captain in July, 1938, and has logged 11,500 hours in the air.

Britain Bombs by Day

A SURE indication of the rising strength of our air-power is provided by the increasing depth of R.A.F. penetrations into German territory on daylight raids. For some time our bombers have been making successful sweeps along and over the Continental shores and delivering damaging blows at enemy shipping creeping along the French coast, but recently a successful daylight attack was made on the power-station at Ibbenburen, near Osnabruck, which lies some 100 miles inland in north-west Germany. Such daylight penetration is a reassuring pointer to the growing power of the R.A.F.'s counter-offensive arm.

New Ground Trainer

A NEW "on the ground" trainer designed for teaching novice pilots how to co-ordinate flight controls is described in the March issue of *Aviation*. Consisting of a seat mounted on a semi-hemispherical base and attached to a 12in. power-driven airscrew, the machine is balanced so delicately that moving the stick forward or back lowers or lifts the "nose," while movement from side to side (which affects the balance of a weight beneath the seat) changes the horizontal axis.

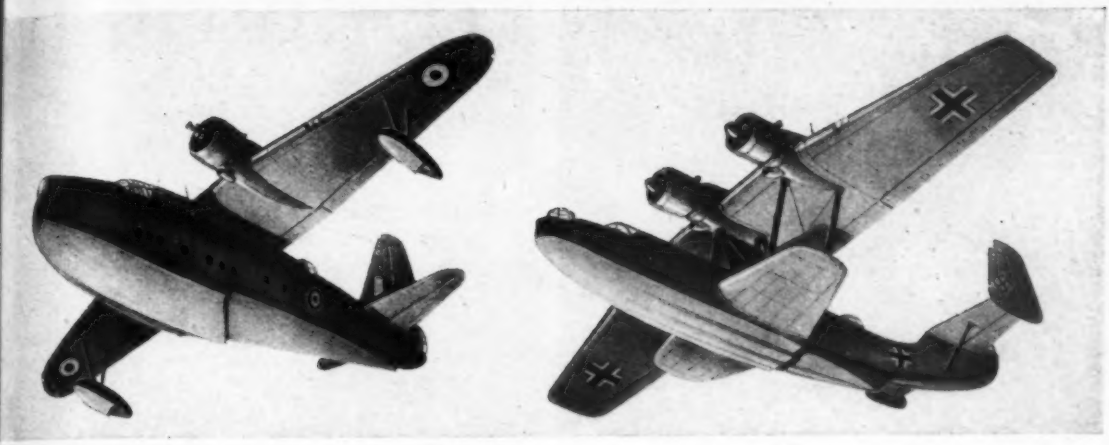
The plane of the airscrew is controlled by the rudder-bar in such a way that the application of, say, left rudder, causes the pull of the airscrew to swing the "nose" to the left. Students are taught to manœuvre by aiming a tiny spotlight at a wood panel on which is painted a series of flight paths. An experienced pilot can immediately put the spotlight just where he wants it.

FIGHTING PRINCE: It is reported that Prince Bernhard of the Netherlands, who recently qualified as a pilot and is here seen wearing his wings, may soon become a fighter-pilot. With him in the picture are Professor P. S. Gerbrandy, Prime Minister of the Netherlands, and M. Beelaerts Van Blokland, President of the Queen's Council.

Eighteenth of the Series

FRIEND or FOE?

British Flying-boat and German Float-plane : Lerwick and Do 24



Saunders Roe Lerwick. High-wing, taper and dihedral outboard of twin radial engines. Short, deep hull ; gun-turrets nose, amidships and tail ; fixed wing-floats. Cantilever tailplane, square-cut fin and rudder with tapering edges.

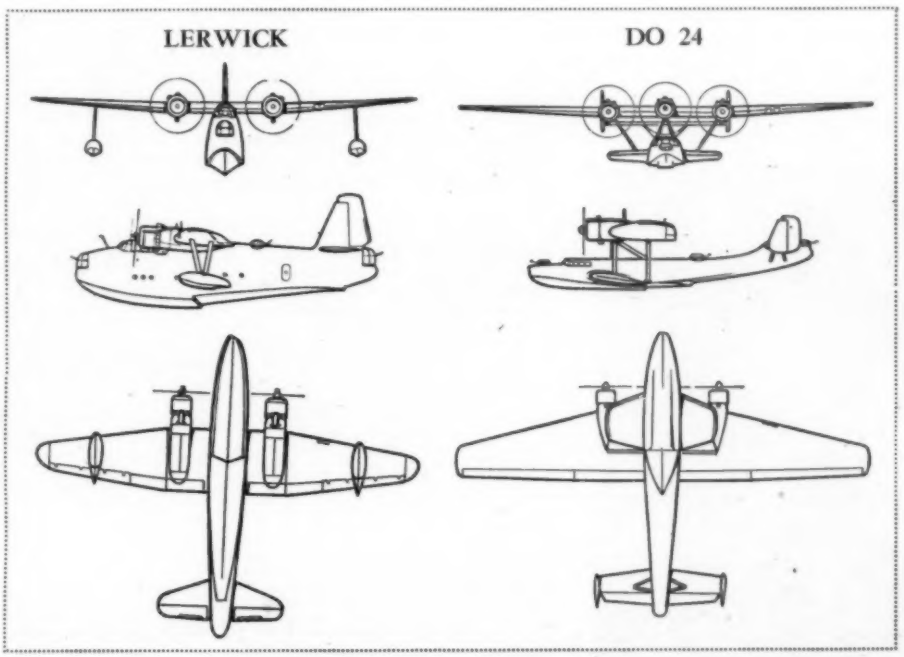
Dornier Do 24. Parasol-wing, sharp taper on leading-edge. Three radial engines. Long, shallow hull with sponsons ; gun-turrets nose, tail and amidships. Strut-braced tailplane tapers on both edges ; twin outrigged fins and rudders.

DESIGNED to replace the Saro London biplane flying-boat, the Lerwick is a fast, long-range reconnaissance-bomber now doing good work with Coastal Command. Its high wing has a pronounced taper outboard from the nacelles of the twin radial engines and, when seen head-on, it will be observed that the slight dihedral begins also from this point. The hull is of considerable depth for its length, which gives the craft a somewhat tubby appearance in side view, but it is by no means ungraceful. There are gun-turrets in the nose, amidships and in the tail, and the rather square-cut fin and rudder has a straight slope to leading and trailing edges. The cantilever tailplane has a pronounced backsweep to its leading-edge. Wing floats also are cantilever.

The Do 24 is mainly in service on Germany's side of the North Sea and it has a cruising speed of about 160 m.p.h. and a range of just over 2,000 miles. Several of these seaplanes were purchased by the Dutch Government when they were first produced for use in the Dutch East Indies and were later built in Holland under licence and fitted with Wright Cyclone engines. Those of the *Luftwaffe*, however, have B.M.W. radial engines. The overall dimensions of the Do 24 are slightly greater than those of the Lerwick, and the parasol wing is characterised by a pronounced backsweep to its leading-edge (the trailing-edge being straight) from the centre-section to the comparatively small, square tips. In plan the three engines are in line, but the middle one is set slightly higher on the leading-edge than the two outboard units to give adequate airscrew clearance above the cabin top. Both the wing and the tailplane are strut-braced (the former to the sponsons) and the latter, which carries outrigged twin fins and rudders, has a taper to both edges. Rotatable gun-turrets are mounted on top of the long, shallow hull—one above the nose, one amidships and the other above the projecting tail—and in the latest version these are reported to be power-driven and to be equipped with 20 mm. shell-guns.

It is known, however, that the Do 24's armament has been the subject of considerable experiment, so some combination of machine- and shell-guns may well be encountered.

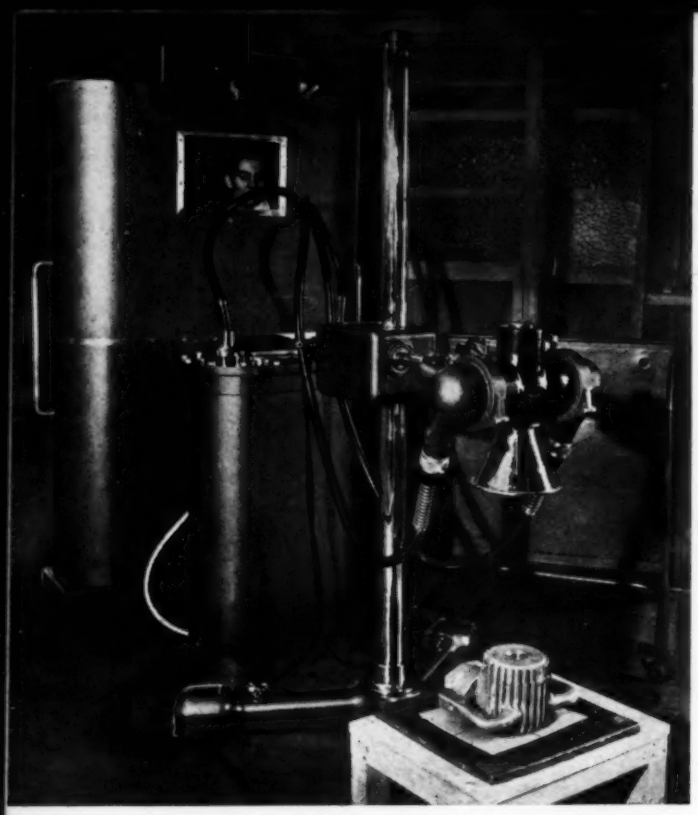
Next week : Grumman Martlet and Macchi C.200.



SEEING IT THROUGH

Aircraft Component Inspection by X-Rays

IN this article, specially written for FLIGHT, E. J. Tunnicliffe, Manager and Chief Radiologist of Siemens-Schuckert (Gt. Britain) X-Ray Division, describes the fundamental requirements of the apparatus employed.



X-RAY EQUIPMENT: A modern outfit showing (from background to foreground) the operator's screen, the oil-immersed transformer and the X-ray tube pointing downwards over a specimen which rests on a photographic plate.

THE popular association of X-rays with medical practice has in the past rather tended to conceal their extremely important and growing application in industry, and surprisingly few appreciate the part played by radiological inspection in the production of modern aircraft.

The evolution of design in aeronautical engineering is essentially directed towards simplification and compactness, with the result that the component parts of any machine are subjected to greater and greater stresses as the designer is furnished by the metallurgist and chemist with the appropriate materials. In the aircraft industry we find that the introduction of new alloys, coupled with advancement in foundry technique, is resulting in the increasing adoption of castings in place of the complicated and costly fabricated parts previously employed.

The defects encountered in light alloy castings include porosity due to gas inclusions, sand inclusions, shrinkage cavities and cracks (particularly where considerable changes in sectional thickness occur), and inter-crystalline porosity.

It will, then, be seen that the ordinary mechanical inspection methods, whereby representative specimens are selected from a batch and dissected, are quite inadequate. It is essential to examine each individual component non-destructively, and X-rays afford the only means available.

Some years ago, X-ray apparatus was both dangerous and fragile—not to mention awe-inspiring. To-day, commercially produced apparatus is as safe as any production tool, structurally robust and not particularly spectacular. The rending high-voltage discharges which once spoke of 50,000 or even 100,000 volts have given way to the casual tones of the radiographer as he mentions operating voltages up to 250,000 and beyond.

Safety Requirements

X-rays had an unhappy introduction. The biological effects of X-radiation were not realised by earlier workers and some considerable time elapsed before they became apparent. The result was that these workers suffered serious burns from the new radiation (commonly and erroneously called dermatitis) and also from the effects of changes in the condition of the blood.

As soon as the harmful effects of X-radiation were appreciated the first steps towards perfecting "rayproof" apparatus were taken. In early apparatus the tubes were housed in heavy leaden boxes. As progress was made these heavy tube containers gave way to the extremely compact tube shields used to-day, from which all stray radiation is eliminated. In some X-ray tubes the production of a well-defined beam is achieved in the design of the tube itself, while in others the stray radiation is trapped by lead barriers incorporated in the tube shields which are relatively small and light owing to the great compactness in design now reached. It can be said, therefore, that modern apparatus projects one well-defined and controllable beam of X-rays, and dangerous scattered

BEHIND THE SCREEN: In this photograph the operator is shown with the exposure switch in hand, and in the foreground is the control panel.

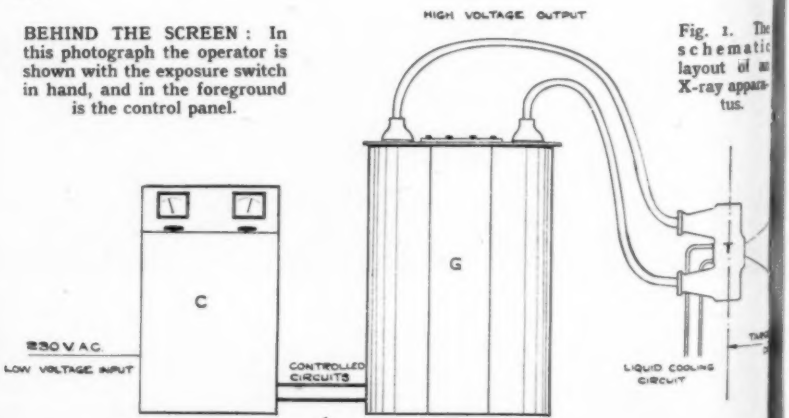
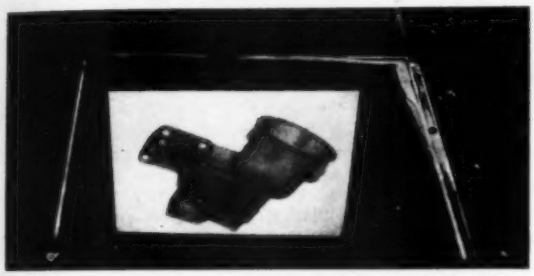


Fig. 1. The schematic layout of an X-ray apparatus.

INVISIBLE STRINGS : The method by which the specimen—a carburettor casting in this instance—is held in the spherical container.



THROUGH THE LOOKING-GLASS : How the carburettor casting appears on the fluorescent screen when viewed through the safety lead glass.

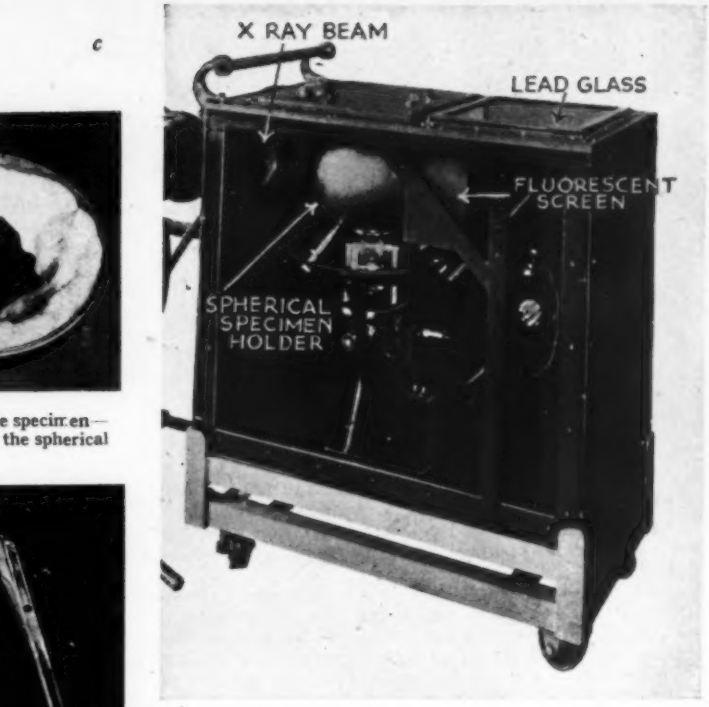
radiation is entirely absent The beam projected can be limited to the area of the specimen by the use of suitable movable screens.

The other aspect of the safety question concerns the high-voltage apparatus used to excite the X-ray tube. Equipments are available to-day operating at potentials up to half a million volts. For light alloy aircraft components, however, the maximum tube voltage is from about 130,000 to 150,000 volts (130 kV. to 150 kV.). Where aluminium bronze and ferrous castings are also concerned, the voltage range of the equipment is usually extended up to between 200 kV. and 250 kV. In any case, it will be seen that the voltages used are extremely high.

Early equipment was built on the so-called "open" principle, in which the various components were insulated on massive porcelain or ebonite pillars, and air was used as the main insulating medium, with the result that a 200 kV. equipment required an entire room to house it.

Oil-immersed Generators

Modern high-tension generators are of the totally enclosed, oil-immersed type. With this arrangement the entire high-voltage circuit is housed within an earthed steel tank and immersed in high-grade insulating oil. The greatly superior insulative properties of oil, and oil-impregnated media, has resulted in a great saving in space and has made portable apparatus possible. A modern 200-kV. generator with rectified output can be housed in an oil-filled tank with cubic dimensions of 3ft. or less. This system of oil immersion, which enables the high-voltage generator to be totally enclosed in a metal case, renders the entire circuit completely shockproof, since the case is earthed. The control circuit is likewise provided with earthed metal housing, while, finally, the tube is supplied through cables with earthed sheaths.



VISUAL INSPECTION : A Siemens-Schuckert "Perspectrosphere" in which the specimen holder is revolved in any direction by an electric motor. Normally, of course, the side is covered to protect the operator.

In dealing with the technical requirements of an industrial X-ray unit we will concern ourselves mainly with the application to aircraft component inspection, although most of the features covered apply equally well to other fields such as welding inspection, etc.

Let us consider the basic principle of an X-ray test. Fig. 1 shows the schematic layout of an X-ray apparatus. Low-voltage power (230v. A.C.) is taken to the control unit "C," where it is split up into several controlled circuits and passed to the generator "G." The generator steps up the mains voltage to a controlled value, and the high-voltage power is then carried by two cables to the X-ray tube "T." From the X-ray tube the radiation projects in a divergent beam, and after traversing the specimen "S" passes through and activates the special photographic film "F."

Radiography

Three main functions are involved in making an X-ray photograph or radiograph:

Kilovoltage.—This term refers to the voltage applied to the X-ray tube and is the factor controlling *penetration*. The higher the tube voltage the shorter is the wavelength

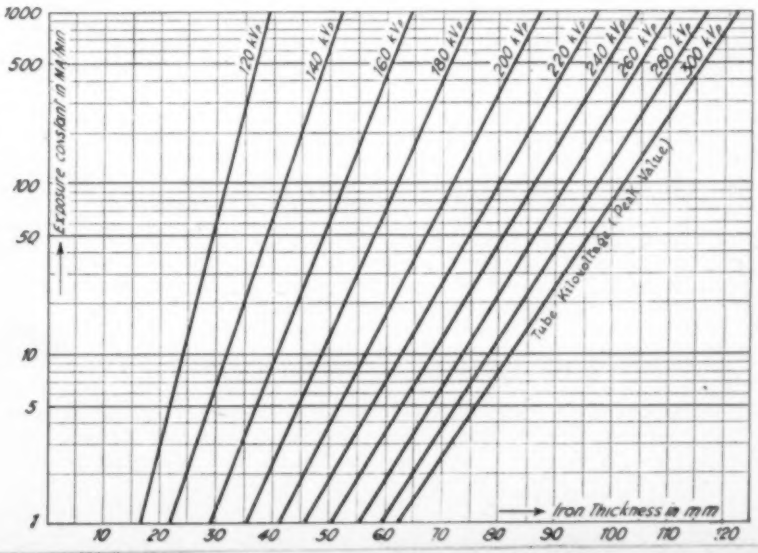


Fig. 2. Exposure curves for iron. Villard circuit. Two intensifying screens. Target-film distance 70 cm. Absolute darkening S = 0.8 ... 1.2.

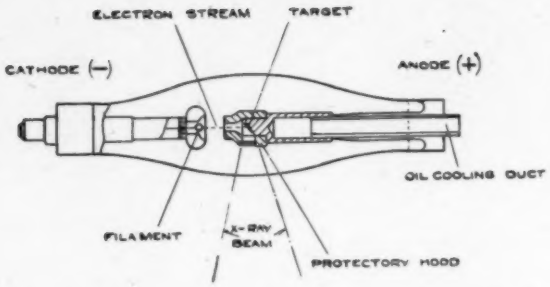


Fig. 3. The arrangement of the various components of an X-ray tube.

of the X-rays produced and the greater their penetrative power. The typical curve in Fig. 2 shows the relationship between tube voltage and penetration for iron (this metal representing a practical and convenient penetration standard).

Tube Current.—This term refers to the current flowing through the X-ray tube and is the factor controlling the density of the beam and hence the *exposure time* required to produce a radiograph of a given nature and thickness of material using a specified tube voltage.

Exposure time.—This term is self-explanatory and the exposure time required for a given quality and thickness of material is dependent upon the tube voltage and tube current used.

The three foregoing factors are, then, very closely related and the following typical example will make this clear:—

Material	..	1in. of iron
Tube voltage	..	120 kV.
Exposure constant	..	15 milliAmps./mins.
Target/film distance		28in.

This means that in order to produce a satisfactory radiograph through 1in. of iron we require a tube voltage of 120 kV. at a tube current of, say, 5 mA. for three minutes or 10 mA. for 1.5 minutes where the film (behind the specimen) is at a distance of 28in. from the X-ray tube.

The degree to which X-rays can penetrate a material depends upon its atomic weight or (more accurately) its atomic number. Thus, with industrial metals, aluminium and magnesium are very easily penetrated, while lead and tungsten offer much greater impedance to an X-ray beam. Between these limits come copper, nickel, tin, iron and the various steels. A practical indication of the relative degrees of penetration can be given. With X-rays generated at 200 kV. the following approximate maximum thicknesses of material can be penetrated:

Aluminium	.. ..	6in. to 8in. (actually limited by scatter effect)
Iron	.. .. ..	3½in.
Copper or brass	..	2½in.
Lead	.. .. ..	⅜in.

Manufacturers of industrial X-ray apparatus provide very accurate curves showing the optimum kilovoltage, current and exposure time required for a very wide range of industrial metals.

Control

In designing the control circuit we see that it is necessary to provide accurate control of the voltage delivered by the high-tension generator to the X-ray tube, and also accurate control of the current passing through the X-ray tube. Exposure time can be regulated by an electric timer or manually with exposure switches and a stop watch.

The output voltage from the generator is usually controlled by one of two methods. In the first case the high-voltage transformer (comprising part of the generator circuit) is supplied through an auto-transformer housed in the control unit. This auto-transformer is provided with tapped windings connected to a rotary switch representing voltage increases in fixed amounts. The second method employs an inductive regulator which has the very great advantage of providing absolutely smooth (stepless) voltage control and also eliminates rotary switchgear. One well-known manufacturer using inductive regulators has provided motor operation so that the many thousands of volts supplied to the X-ray tube can be accurately adjusted by simply holding down a press-button.

The necessity for smooth and accurate voltage control becomes greater at the lower end of the voltage range. Such defects as segregation and inter-crystalline porosity necessitate, in many cases, the use of very low voltages in order that they be clearly defined.

Tube current control is simpler and usually takes the form of a rotary resistance coupled to the transformer feeding the X-ray tube filament. Both electrical functions are indicated by suitably calibrated meters—one calibrated in tube voltage and the other in tube current.

Modern equipment also incorporates various protectory devices which switch off the apparatus in the event of safe maximum values being exceeded, thereby protecting the costly components of the equipment such as transformers, condensers, rectifiers and X-ray tube.

Generator

The design of high-voltage generators is a complicated business, and the finer points of high-voltage technique need not be referred to here. Broadly, three types of high-voltage generator are used. The first type consists simply of a step-up transformer which supplies the X-ray tube with alternating current. This type of generator has the advantage that it is cheap and simple to construct and is compact in design, since only one component is required for supplying the high voltage.

For industrial use, however, the A.C. generator has certain disadvantages. Under certain conditions of operation the tube may tend to pass current in the reverse direction and this would result in its immediate destruction.

The second type of generator delivers a rectified pulsating output to the X-ray tube. A typical arrangement is called the Villard circuit. By an ingenious system of coupling rectifying valves and condensers with the high-voltage transformer a method of "voltage doubling" is achieved. The output voltage is doubled by means of charged condensers which hold and then add their charge to the transformer output at intervals.

The third type of generator supplies the X-ray tube with pure direct current. The circuit is, however, bulky and is unnecessary and rarely employed.

To summarise, it can be said that for all-round efficiency the Villard generator delivering rectified output is the best type for industrial work, and properly designed industrial apparatus to-day incorporates this type of high-voltage circuit. A modern X-ray installation for aircraft work operating at voltages up to 140,000 is illustrated

X-Ray Tubes

In considering the suitability of an X-ray tube for industrial work, two very important qualities are involved.

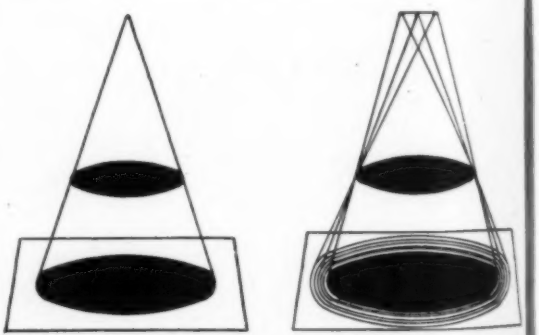


Fig. 4. Diagrams showing the need for a small target area in order to produce a sharp image.

SEEING IT THROUGH (Continued)

SEEING IT THROUGH (Continued)

The first is that the tube must be capable of operating continuously for indefinite periods at maximum voltage and with a reasonable tube current.

Since the exposure time is directly proportional to the tube current (radiation density), and since the density of the X-ray beam varies inversely with the square of the distance from the tube target, the necessity for a reasonably high tube current (5 to 15 mA.) will be apparent. This is particularly the case where the need for long target film distances arises.

Owing to the fact that an X-ray tube tends to pass less current with a reduction in operating voltage, it is, in addition, essential that a tube for industrial use be capable of passing sufficient current, also at very low voltages, in order that radiographs may be taken without unduly lengthy exposure periods.

Target Area

The second feature called for is that the tube should possess a very small target area. Fig. 3 illustrates, diagrammatically, the physical arrangement of a modern self-protective tube. The tube comprises an evacuated glass vessel into which are sealed two electrodes—an anode and cathode. The cathode (negative electrode) comprises an incandescent filament constituting a source of free electrons. The anode (positive electrode) forms—over a small portion of its area—the target to which the electrons are projected (by the very high voltage across the tube) and from which the X-rays generated by electronic bombardment radiate outwards in straight divergent lines. This type of tube has a hooded anode which traps all unwanted radiation and permits only the required beam to emerge.

Referring now to the target, it will be appreciated that considerable energy is dissipated at this point. For example, a modern tube operating continuously at 200 kV. 10 mA. may dissipate 2 kilowatts over an area of only 5 millimetres square, necessitating adequate cooling. Should the cooling of the target become inadequate, it might very quickly become incandescent and proceed to emit electrons which, during the negative half-cycle with an A.C. operated tube, would fly across and bombard the relatively delicate filament, thereby wrecking the tube as previously described.

What is the reason for limiting to an absolute minimum the area of the target? Fig. 4 makes this point clear. It will be observed that when projecting an image of a specimen "S" upon a film "F" the quality of definition increases as the source of radiation becomes smaller. With the very small flaws encountered in industrial work it is, therefore, absolutely essential that the X-ray tube be capable of producing a clear image of such flaws, and the use of a tube with a coarse or large target might easily mask a dangerous defect. In the case of inter-crystalline porosity, tubes with target areas of only 0.6 mm. to 1.5 mm. square are sometimes used

The effect of a point source of radiation is further increased by positioning the X-ray tube at a considerable distance from the specimen, and target-film distances of 50in. are not uncommon.

As far as structural design is concerned attention is drawn to the lay-out. It will be seen that the various items of equipment are compact and easily transportable. A very important component in an aircraft X-ray unit is the tube stand, and this should be capable of enabling the X-ray tube to be rotated about all its axes. Although most radiographic work is carried out with the X-ray beam projecting vertically downwards, the necessity frequently arises for "angle shots" where the form of a particular casting involves special radiographic technique. The tube stand must also be structurally rigid to prevent vibration or accidental displacement of the tube during operation.

Radiography and Fluoroscopy

According to the importance of the part they play, aircraft components are either examined radiographically or visually with the aid of a fluorescent screen.

INSIGHT : An operator inspecting a radiograph of a light metal casting. The image is clipped in front of an illuminated opal glass.

The process of radiography, as we saw in Fig. 1, consists of recording, on suitable film, an X-ray "shadowgraph" of the internal structure of the specimen. Film manufacturers now produce special films for industrial work, and one well-known concern has recently perfected and marketed a new type of film enabling radiographs of the highest degree of definition to be obtained. In general, the flaw discrimination of X-ray film under well-controlled conditions can be as fine as 0.5 to 1 per cent. That is, flaws which represent only one-half or one per cent. of the total thickness of the specimen can be detected.

When dealing with aluminium and similar light metals the X-ray film is, in most cases, activated by the X-ray beam only. When, dealing with steel and other heavy metals, however, the exposure time is substantially reduced by employing "intensifying screens." These screens consist of crystals or zinc-tungstate thinly deposited upon card backings and possess the property of fluorescing under the influence of X-rays. The X-ray film is sandwiched between a pair of intensifying screens and is, therefore, activated by the fluorescent light in addition to the X-radiation.

Fluorescent View-screens

The fluorescent screen consists of a film of barium platino-cyanide crystals which fluoresce under X-radiation. A specimen interposed between tube and screen casts a shadow upon the screen, the brightness of which varies inversely with the thickness of the specimen. This method of inspection is much less revealing than the radiographic method. Flaw discrimination of between 5 and 10 per cent. is usually achieved under practical conditions.

One of the disadvantages of fluoroscopic examination concerns the question of safety, and screening apparatus has to be very carefully designed and constructed to ensure that the operator is protected against stray and scattered radiation.

It is found that maximum efficiency in inspection conflicts with the provision of adequate safety. Latterly, however, X-ray manufacturers have perfected various screening units which are entirely safe and also highly efficient.

It remains to be pointed out that the evolution of the precise and highly efficient methods of X-ray inspection of aircraft components now established in this country are very largely due to the specialised applications developed in the Aeronautical Inspection Directorate of the Air Ministry.

In conclusion, a compliment might be paid to the British X-ray industry. Before the outbreak of war specially designed industrial X-ray apparatus was obtainable only from foreign sources Since the outbreak of war certain British manufacturers have not only designed, developed and perfected X-ray apparatus for industrial work with performance superior to that of foreign equipment, but have also made it commercially available. In fact, a number of these newly developed equipments are to-day fulfilling their most important rôle in the war effort.

Foundations of fame. The Hawker Fury single-seater fighter was standard equipment in the R.A.F. for many years.

BIRTH OF A GREAT FIGHTER

Converging Lines Meet and the Result is the Typhoon: How Two Now-famous Designers Have Grown Into Close Collaboration

By C. M. POULSEN

LAST week the general British public, and, one may be sure, the world at large, was told something of the new 400 m.p.h.-plus fighter which is now in production for the Royal Air Force. I was informed that the speed of the Typhoon is well over 400 miles per hour, that the ceiling and rate of climb are remarkable, that the armament and armour are far heavier than those of the Hurricane, and that the engine is a liquid-cooled Napier Sabre developing more than 2,000 b.h.p.

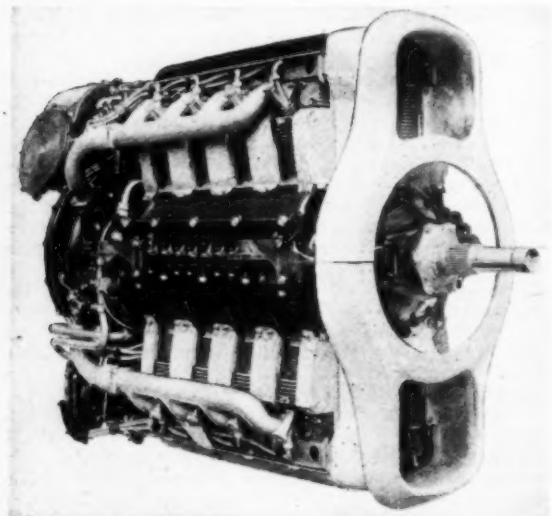
This very remarkable aeroplane marks the culmination of the growth and development of two designers who, one on the aircraft side and the other on the engine side, have both followed their respective professions from practically the beginnings of British aviation. As it has been my very good fortune to be privileged to follow quite closely the work of both, not merely by studying actual results but during the planning and evolutionary period, I am able to appreciate the separate stages in the long history which has led up to the production of what seems likely to prove the world's fastest single-engined fighter—certainly if in addition to speed one takes into account such things as range, ceiling and firing power. And it is quite remarkable how one can trace the logical steps by which the paths of these two designers, one of the aeroplane and the other of the engine, have tended to converge towards the logical and inevitable marriage of their two brain children.

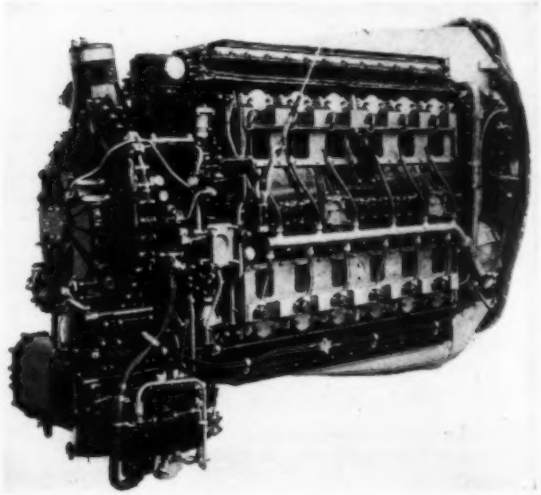
I first made the acquaintance of Mr. Sydney Camm, now chief designer of Hawker Aircraft and head of the team which has created the Typhoon, when he was in the drawing office of the Martinsyde company at Brooklands. That was in the period which the French so aptly describe as the "heroic" days of flying. Martin-and Handasyde were building monoplanes which had a strong resemblance to the French Antoinette, with long tapering wings braced by cables and king posts, and driven by Austro-Daimler water-cooled engines. They were very graceful aeroplanes, and it is likely that it was in this early school that Sydney Camm acquired and developed that unerring eye for good lines which is so evident in all his creations. In later years I have known him drive his staff nearly to distraction by flatly refusing to alter by one iota some cowling curve which he wanted; other things would have to be changed and rearranged to accommodate it, but that curve had to be worked in. Always some way was found, but not without going to endless trouble. The expression "that will do" does not figure in Camm's vocabulary.

Early Monoplanes

Due to certain wing failures in the air, the monoplane type was banned in this country for several years. Little was known of stress calculations other than the most elementary, and less still of the wandering of the centre of pressure which could cause unexpected loads in wing members. The Martinsyde firm changed over to biplanes in deference to official views, and some very fine examples were produced during the world war. Financial difficulties compelled the dissolution of the Martinsyde firm after the war, and Sydney Camm had to find work with another firm.

In time he settled with the Hawker company, and there was given his first great chance by being given the task





Major Halford's first "H" engine, the Rapier, had its 16 cylinders arranged in banks of four. (Right) The intermediate step. The Napier-Halford Dagger was of 24 cylinders, air-cooled, and laid the foundation for the modern Sabre liquid-cooled, which has the same number of cylinders.

First collaboration. The Hawker Hector was one of the many Hart variations, and had the Napier-Halford Dagger engine. In the Typhoon the two designers have worked together again.

of designing the little Cygnet biplane for the Lympne light plane competition. Mr. Carter, who was at that time Hawker's chief designer (and who now holds the same post with the associated Gloster company, explained to me that he had turned the Cygnet over to Camm. "I have not yet," he said, "become accustomed to thinking in ounces instead of pounds."

The Cygnet was a triumph in structural engineering. With proper load factors it would carry its own weight as disposable load, and it may be that it was while designing the Cygnet that Camm formed the habit of scrutinising so closely every single structural item for possibilities of weight reduction. The success of the Cygnet was such that, when Carter left, Camm was his obvious successor; he has been chief designer of Hawkers ever since, and has been responsible for such well-known types as the Hart, all its variations, the Hind, the Fury, and the Hurricane, to mention but some of the types which were put into large-scale production for the R.A.F.

Practical Experience

Here it seems appropriate to leave Mr. Sydney Camm for the moment and to turn to the history of his "opposite number," Major F. B. Halford. I think I first met Frank Halford when he was acting as mechanic to Warren Merriam, who was at that time in charge of one of the Bristol flying schools. Halford wanted experience, and in those days there was no better way of getting it than by taking one's gloves off and getting down to it. The engines used in the Bristol box-kites were Gnome rotaries, and they wanted a lot of nursing if they were to be kept running. The workmanship was very fine, it had to be with a delicate mechanism such as the automatic inlet valves in the crowns of the pistons, but the design was such that the engines were likely to be highly strung and temperamental.

There is no need to follow the career of Major Halford in great detail in order to obtain an impression of the steps by which he was led to evolve the Sabre engine, but it is necessary to place on record at the very outset the fact that he has always been an advocate of the in-line engine. During the world war he was the "H" in the B.H.P. engine, the initial letters representing Beardmore, Halford and Pullinger respectively.

This engine was a six-cylinder water-cooled of some 230-240 h.p. The engine was later re-named and called the Siddeley Puma, Sir John Siddeley (now Lord Kenilworth) building thousands during the war.

After the world war Major Halford set up as an independent designer. One of his first jobs was to titivate the R.A.F. engines held by the Aircraft Disposals Company.

To Mr. Philip Lucas goes the honours for doing the flight-testing of the Typhoon.

Responsible for design. Mr Sydney Camm, whose team produced the Typhoon. On the right, Major Frank B. Halford, originator of the "H"-type aero engine, who designed the Sabre which helps to give the Typhoon its remarkable performance.

BIRTH OF A GREAT FIGHTER (Continued)

persuading them to give a little more power. Out of that work grew the Cirrus light plane engine, the Mark I of which was virtually one bank of the R.A.F. vee, placed vertically. The Cirrus engine made good, and in turn made possible the De Havilland Moth, which was the first really practical light aeroplane, powerful enough (about 65 h.p.) and robust enough to be suitable for school work.

The Cirrus engine gave Aircraft Disposals a virtual monopoly in the light plane market, but the business policy of the firm was somewhat unyielding in the matter of price, and so the De Havilland Company decided to establish an engine department of its own. Major Halford was chosen to do the designing, and the long series of Gipsy engines destined to win world fame was the result. The Gipsy I, II and III, the Gipsy Six and the Gipsy Twelve were all in-line engines and all air-cooled. The original engine was "right way up," but subsequent types were inverted, thus giving the pilot a better view while still keeping the thrust line in a reasonable position.

The First "H" Engine

By the time the Gipsy series was going nicely the Halford reputation was firmly established, and he was asked to do design work for D. Napier & Son, Ltd. He had in the meantime been studying all possible cylinder arrangements, and had come to the conclusion that the so-called "H" arrangement had many advantages. Small frontal area was one of them, and as that was a feature for which the aircraft designer was always looking, it is scarcely surprising that the first engine designed by Major Halford for Napiers was of this type. It had its 16 cylinders arranged in four banks of four each and was air-cooled. It became known as the Rapier, and among the aircraft types in which it was used were the Fairey Sea Fox (which did such good work in the fleet action against the *Graf Spee* during the present war), and *Mercury*, the upper component of the Short-Mayo Composite. *Mercury* made some very notable flights, including the Atlantic crossing and the flight from England to South Africa. The Rapier, by the way, developed 350-390 h.p. according to the series.

The Rapier was rather small for most types of service aircraft, but it had taught both the designer and the manufacturers valuable lessons. It was thus logical that the next and more powerful type should follow the same general layout. The Dagger was however, a 24-cylinder engine, each bank having six cylinders. With a power of 725 h.p. it was suitable for military aeroplanes, and in the Hawker Hector, one of the many variations on the original Hart theme, the two designers, Camm and Halford, collaborated for the first time. Our photograph shows how well the Dagger fitted into the scheme of things. At least that is what we all thought at the time. Further collaboration has resulted in an even better merging of lines in the Typhoon, although the Sabre is a much more powerful engine than the Dagger.

Pre-war Planning

It would not, perhaps, be wise to disclose how long ago it is since I first became acquainted with the scheme which has now come to fruition under the name of Typhoon. I can say, however, that I discussed the layout of the design with Camm long before the present war, and I had many an interesting talk with Halford in the days when the Sabre was but a single cylinder being run to death on the test bench. Much water has run under the bridges since then, and a few changes were made before that one cylinder acquired 23 sisters and became the Sabre. The single-cylinder research was necessary not only because liquid cooling was to be used, but for other reasons which I cannot disclose here. And, incidentally, the Sabre very nearly became my undoing in that I inadvertently mentioned it by name in *Flight* at a time when it was very hush-hush. The Air Council expressed its severe displeasure, but my explanation of how the slip came about was generously accepted, and I was permitted to live.

To show the closeness of the collaboration between Camm and Halford which has now made possible the Typhoon fighter, I may mention that as the aircraft design was somewhat ahead of the engine, the Napier Company made up a very elaborate wooden mock-up of the engine for the Hawker firm. That gave the aircraft designers a chance to study the installation in every detail, and it is safe to say that had it not been for this mock-up, the Typhoon would not to-day be the remarkably compact aircraft which it is. Such things as cowling lines and their continuation into the lines of the fuselage proper could be determined with accuracy. The pilot's view over the top and past the sides of the engine could be tested.

As to the Typhoon itself, readers may like to play an interesting game by trying to imagine how Mr. Camm would design a successor to the Hurricane, bearing in mind the larger engine, greater petrol load, heavier armament and armour, and other weight-making items growing out of the 2,000-plus horsepower.

Forerunner of the Typhoon. The Hurricane's clean lines and small frontal area may be expected to be continued in the new fighter, although this is probably a somewhat larger aeroplane.

Topics of the Day

SHAPES AND SIZES

Strange Aerodynamic Effects Sometimes Experienced : Visible Air : Design is Still Fluid

IT is a terrible thing that expressions are so often worked to death, and that they consequently cease to have any real importance and even change their meanings altogether. A lot of really good and expressive and sometimes even true bundles of words have been so continually used as to become mere platitudes and forthwith cease to be current. Since I am supposed to unburden myself only on matters pertaining to flying, and since there is an undoubted shortage of paper, I will not waste time or paper by quoting examples, but come to the real point for what it is worth.

Strangely enough, the platitude or cliché which I need to use is still superbly true. "If it looks right, it *is* right" may not apply to everything, but it usually applies in very large measure to aeroplanes, though there have been, and still are, some strange-looking birds grinding through the sky which still appear to do their work remarkably well. Perhaps the expression should only apply to appearance through the eyes of designers who know what to look for and what to look at.

Perhaps not. Any pilot will tell you that most of the very strange-looking birds behave queerly in at least some respects, and a great many airline and other people travelling in aeroplanes have the pilot to thank for their safety. The pilot, that is, helped by such things as automatic pilots. By itself such an aeroplane would make a very sorry show.

The Public Never Knew

There have been squat affairs which were very unstable and which gave the pilot heart failure on almost every trip; there were odd-looking things which had a monumental lack of any sort of control near the stall and which turned sharply over on to their backs at the slightest provocation when being flown slowly; and there were aeroplanes which flew level in the most peculiar attitudes—only the designers knew how much speed was being lost in the process. The great flying public was not told of nervous breakdowns, of the long periods of special training which were instituted for pilots flying certain types, or of low cruising speeds. They, very rightly, merely paid their money and were transported from place to place in the most remarkable comfort and generally at the most remarkable speeds. The struggles up in front were neither seen nor heard, but privileged and sufficiently knowledgeable persons who rode up in front usually came away with new and better ideas.

Those are fairly straightforward little troubles. Often the strangest things happened to aeroplanes which are only very slightly queer in their appearance. But to balance cases of normal deficiency there are, of course, an equal number of cases where quite ordinary—but *not* ugly—machines performed far better in any possible way than the designer hoped. From peacetime days we know of the truly remarkable performances of such types as the Gauntlet and Gladiator, to quote only two cases. Unfortunately, one very rarely thinks of the good examples. At the other extreme I can think of one fairly modern type which flies quite quickly at cruising boost, but which, when everything is opened up to "five minutes only," goes only fractionally more quickly, and which has to be stuffed down very hard to produce results. Needless to say, this is not now an operational type.

It is natural to expect that the cause of such simple performance failures or successes is to be found in a fairly straightforward question of fuselage shape. The attitude adopted at the natural cruising speed may be perfect, while that adopted at any higher speed (or greater power output) may be quite inefficient. In fact, so many factors enter into the matter of general performance that it may be quite impossible to know what is really going on. The design of the wing roots may be the cause of the trouble; or the way in which the slipstream reaches and passes the fuselage; the entry shape of the nose, or even the degree of negative incidence in the tailplane.

Wind Tunnel Tests

A certain amount can be discovered in small-scale wind tunnels, but until full-scale tunnels are normally in use it is necessary for air to be made temporarily visible in some way or another. The good old wool-tuft-cum-cinematograph business seems to be as good as any, but such experiments presuppose the building of a full-scale aeroplane with all that it entails. It is a bit late then to find that all is not exactly what the designer planned and thought when he organised the original layout. Nor can we always blame the designer in cases where design has, so to speak, outstripped performance. He usually finds that he has to stuff so much material about the place that he cannot possibly retain the shape or even the layout which he originally visualised.

It is all very hard work, and much design is still very largely a matter of rule-of-thumb. The arrangement which was satisfactory yesterday is likely, but not necessarily, to be equally satisfactory to-day. Only when much greater sizes are being considered, or when the design is particularly revolutionary, are really serious snags usually found. To quote one very elementary example, one can think of the way in which, a few years ago, everyone went mad about wing-root fillets. The air must be smoothed in those parts, and so on. Nowadays it is much more normal, if not quite normal, to find that no arrangements of any kind are made at the function point, and that the wing just sits squarely into the fuselage. Not only does it make no difference, but "square" entries are often more successful. Probably the most outstanding cases of this kind appear in present-day American aeroplanes—and America, I believe, is where the wing root was first "invented." You have only to look at some of the quaint types emanating from that country—many of them with very fair performances—to realise that shape really has very little to do with anything when we are dealing with really high speeds.

Queer but not Ugly

Reverting momentarily to the original platitude, it should be mentioned that queerness is not necessarily ugliness. Some of the modern military types are certainly queer, but they usually look the part, and that is the criterion. The oddest of odd Brewster Buffalos, for instance, looks more or less what it will do, but the majority of pilots were taken in by its shape to the

SHAPES AND SIZES (Continued)

extent of expecting it to be exciting and manœuvrable, but tricky and rather dangerous. From what I hear it is neither of the latter, so the platitude is not always right.

The new shapes prove what I have always thought, that the design of aeroplanes is still only starting. Nobody knows what the shapes will be like at the end of ten more years. Probably quite different. It is encouraging to see that queerness of appearance is not a characteristic of the machines used, or at least so far described, by the Axis Powers. Only by queerness mounting on queerness can things be discovered. Eventually a *very* queer aeroplane will be produced which will be far, far faster than anything yet built.

"INDICATOR."

"MOORE - BRAB" AT MILLBANK

Britain's No. 1 Pilot Becomes Minister of Aircraft Production

LT.-COL. J. T. C. MOORE-PRABAZON, M.P., Britain's No. 1 pilot, has now taken up his new duties as Minister of Aircraft Production in succession to Lord Beaverbrook who, since Mr. Churchill created the M.A.P. twelve months ago on the formation of his new all-party Government, has spared no effort to expand the production of warplanes to a pitch which would enable us to compete with the Germans on something like numerical equality. There have been those who did not always see eye-to-eye with his methods, but by his relentless energy he has "delivered the goods," and his successor, who during the same period has been Minister of Transport, takes over command of a vital department which has already been running for some time on full boost. One of this country's pioneer airmen, Lt.-Col. Moore-Brabazon not only holds the first pilot's certificate issued by the Royal Aero Club, but in the autumn of 1909 he won a £1,000 newspaper prize for being the first man to fly a circular course of one mile. This he achieved in a Short biplane, landing again at his starting point.

The new Parliamentary Secretary to the M.A.P. is Mr. Frederick Montague, M.P., who was Under-Secretary of State for Air under the late Lord Thompson. Mr. Montague has always maintained a lively interest in aviation matters, and his comments and questions in debate have never failed to show a sound judgment. Incidentally he is an amateur conjurer of no mean order, an attribute which, it may be suggested, should come in useful in helping to produce limitless aircraft out of the Ministerial hat!

The Ministries of Transport and Shipping are now combined under the new heading of Ministry of Wartime Communications and may well take civil aviation under its wing. Mr. F. J. Leathers, who is to be head of the new combined Department, is a prominent industrialist with shipping experience which should stand him in good stead in securing a unified control of the country's chief transport systems which, it is believed, will also bring the railways under his guidance.

Lord Beaverbrook's indefatigable energies will, of course, have a much wider scope in his new role of Minister of State. Thus freed from the responsibilities of any one particular department, he will be able to bestow the impetus of his dynamic personality upon any section of the national war effort which seems to require it. The record of his vigorous handling of the M.A.P. during the past twelve months is surely an assurance that the new Minister of State will not fail to exercise his wider powers in equally purposeful manner and to make his presence felt wherever and whenever he deems it necessary.

P. and P. Changes

ON April 28th Rolls-Royce, Ltd., made the following announcement: "Rolls-Royce, Limited, have disposed of their shareholding in Phillips & Powis Aircraft, Ltd. The directors, Mr. A. F. Sidgreaves, Mr. E. W. Hives, and Lt.-Col. M. Ormonde Darby, are resigning from the board. The relationship between the two companies in the future will be on the same friendly business lines as exist between Rolls-Royce, Ltd., and other aircraft manufacturers." From Phillips & Powis Aircraft, Ltd., we learn that the shareholding sold by Rolls-Royce, Ltd., has been bought by Mr. F. G. Miles. Mr. Miles, as our readers will remember, has been chief designer to P. & P. since 1932, and has been managing director since 1937. He will continue in these two capacities, and his co-directors will be Mrs. Miles, his wife, and Mr. George Miles, his brother.

We can imagine that this must be a happy moment in the life of Mr. F. G. Miles. He has come a long way since those early days when he designed light planes at Shoreham (before he went to Phillips & Powis), and will go further still. He would, we believe, be the first to give to his wife full credit for his success. Of one thing we may be sure: P. & P. will continue to pursue a vigorous experimental policy.

Carried Unanimously!

LT.-COL. SIR FRANCIS F. McLEAN, A.F.C., has been elected chairman of the Royal Aero Club for the present year, and Major H. A. Petre, D.S.O., M.C., was elected vice-chairman at the same meeting. Both were unanimous.

LEAR GYROMATIC NAVIGATOR

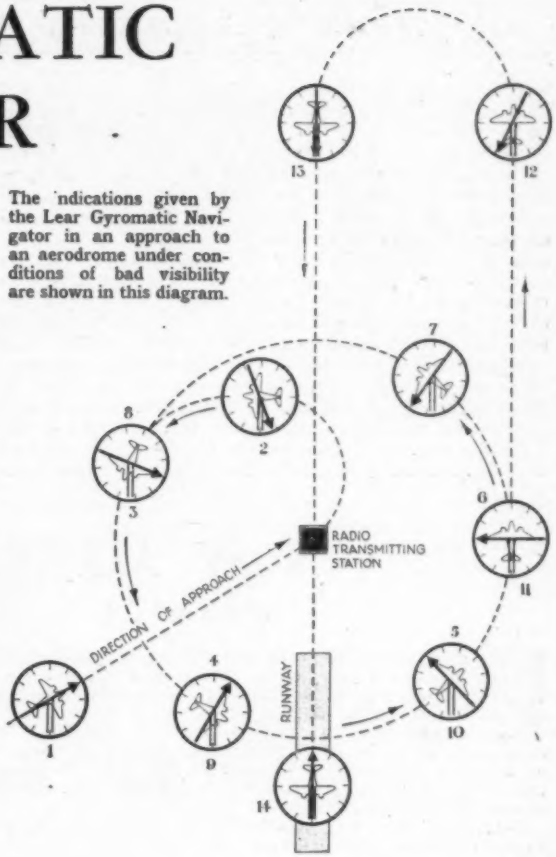
Directional Gyro and Radio D.F. Indications Given on One Dial

THE gyroscope, by its ability to define a constant direction in space, has done much towards solving the problem of navigation in bad weather. So also has radio direction-finding, and the principle of rotating a loop aerial until the signal strength is a minimum and thereby determining the direction of the station transmitting is very well known to all pilots and navigators. To have the direction of the station indicated automatically and continuously by a pointer on a dial without the necessity of manually rotating the loop is a convenience, but to have the reading of the directional gyro added to the same dial is an additional help to the navigator which can do much to ease his mental strain in times of difficult flying conditions. Such an instrument is the Lear Gyromatic Navigator, invented by 38-year-old William P. Lear, head of the American radio firm of Lear Avia at Dayton, Ohio.

The dial of the instrument is shown in the illustration and the pointer is governed by a radio direction-finding set so that it continues to point towards the station to whose wavelength it is tuned. There is no necessity for this to be a beam or a D.F. station, even a broadcasting station will do. The double line is etched on a lightweight transparent disc above the pointer and is controlled by the directional gyro housed in the base of the instrument. This double line can be set to any desired direction and will remain in that direction irrespective of the manœuvres of the aeroplane.

The miniature aeroplane seen is etched into the glass cover of the dial, this being a fixture relative to the instrument and therefore to the aeroplane. So the miniature is merely a reminder to the pilot of the direction in which his aeroplane is pointing; it helps him to visualise the relations between his aeroplane and the radio station being used or the aerodrome being approached. The remaining feature on the dial is the card over which the other elements are mounted. This card is graduated into 360 degrees and can be rotated and set as desired by means of the knob at the base of the dial.

The four elements of the dial are :—1. The card which can be rotated and set by the knob at the base. 2. The pointer controlled by the radio D.F. set. 3. The double line indicator of the directional gyro, and 4. The miniature aeroplane etched on the fixed glass cover.



The indications given by the Lear Gyromatic Navigator in an approach to an aerodrome under conditions of bad visibility are shown in this diagram.

Approach Procedure

The other illustration shows the indications given by the Lear Gyromatic Navigator in an instrument approach to an aerodrome which has a radio transmitting station on the line of direction of the runway to be used in bad weather. The dotted line shows the flight path of the aeroplane in the approach and subsequent landing. The circles on this path show the indications given by the gyromatic navigator at these various stages of the approach. At position 1 the aeroplane is homing towards the radio station and the pointer points to zero of the scale (assuming that the scale has been set so that its zero lies on the fore-and-aft line of the aeroplane). The discerning reader will say, What about drift? If there is any, the pointer will move from the zero as the aeroplane is drifted; the pilot then applies rudder to bring the zero under the pointer and so is sure that his aeroplane is again pointing towards its destination. This process continued will bring the aeroplane over the radio station, though its path will not be

LEAR GYROMATIC NAVIGATOR (Continued)

a straight line but a curve. During the approach the double line is set on the direction of the runway which is to be used.

As the radio station is passed over, the pointer suddenly turns through 180 deg., so giving an unmistakable indication of the position of the aeroplane. Then follows a standard procedure turn to the left, position 2, which continues until the radio station comes directly abeam, position 3. The pilot then eases his turn into a larger radius four-minute procedure turn to circle the station and keep it directly abeam as seen in positions 4, 5 and 6. If the altitude still exceeds 1,000ft., it is necessary to complete another circle through the positions 7, 8, 9, 10 and 11 while losing altitude at such a rate that at position 11 the aeroplane is at 1,000ft. This position is easily identified by the fact that the double line of the directional gyro is at 180 deg. on the scale and the pointer is indicating 270 deg.

Having reached position 11, the flight path is then kept straight on a course parallel to the runway and away from it, keeping the double line on 180 deg. The pointer reading gradually decreases as the aeroplane moves away from the radio station, and at a certain value, fixed by the procedure for the particular aerodrome, the pilot does a left-hand two-minute turn of 180 deg., so lining himself up with the runway at the correct distance from it and altitude above it, position 13. Both the pointer and the double line of the gyro now point ahead, to zero on the scale. Altitude is then lost as the runway is approached and the pointer suddenly reverses as the radio station is passed over, thus giving a definite indication of the distance from the runway. The final approach and touch-down can then be made, position 14.

The novelty of the Lear Gyromatic Navigator consists in bringing together the indications of two instruments whose value has already been well established. It should be of considerable help to a pilot as it allows the easy visualisation of the problem confronting him in conditions of zero visibility.

NEW AIRGRAPH SERVICE

Photographic System Will Expedite Middle East Mail

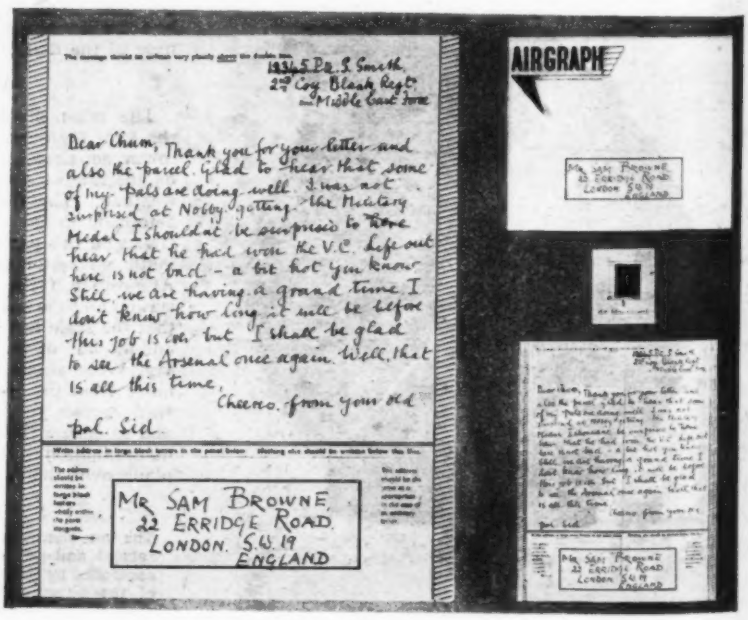
LIKE most clever ideas, the new "Airgraph" system of sending letters between this country and the Forces in the Middle East, which was announced in last week's issue of *Flight*, is a delightfully simple one. It saves days in transit time and costs the sender only a fraction of the expense of ordinary air-mail. Briefly, the sender writes the message on a special form which is photographed on a film negative measuring only ¼in. by ⅜in. from which a readable enlargement is reproduced at the other end.

As 4,500 of these tiny negatives weigh only one pound as against the 1½cwt. which would be the weight of an equivalent number of ordinary letters, the saving in weight and space for transit by air will be appreciated. By virtue of this saving the fighting man in the Middle East and his family and friends at home will be able to correspond at the cost of 3d. per letter. Moreover the time taken for the letter to reach its recipient will be less than a fortnight, whereas ordinary air-mail letters, owing to their weight, have to be carried part of the way by sea and thus take very much longer.

The homeward Airgraph Service will begin almost at once and a similar outward service from this country to the Middle East will follow as soon as certain technical arrangements can be completed. The service is, of course, supplementary to the normal postal service and it admittedly has two slight disadvantages—it is not entirely private and it imposes a limit on the length of the letter sent. But in practice these snags are more apparent than real. It is true that an Airgraph letter cannot be sent all the way in a sealed envelope, but it is delivered sealed to the recipient, and it can obviously be taken for granted that the postal staff who photograph and reproduce the letters will have no personal interest in their contents nor time in which to notice them.

As regards the limit on letter length, the form on which the sender writes the message measures 11in. by 8in. (including the margin for the recipient's address) and quite a lot can be said in this space. Incidentally the enlargement received at the other end measures 5in. by 4in. which, unless the sender were to write his original letter in an extremely tiny hand in order to cram in an abnormal amount of matter, will be found to be quite big enough for easy reading.

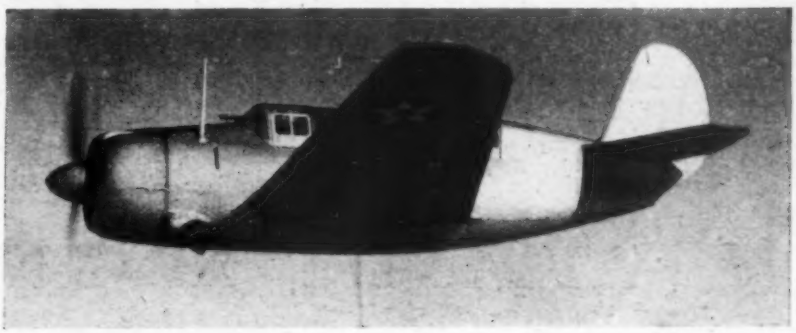
This system of cheapening and expediting postal communication between the Middle East Forces and the home country is the first of its kind in the world and has been evolved by the Post Office in co-operation with a well-known photographic firm who have sent an expert out to the Middle East to supervise that end of the undertaking. The Airgraph Service has the full co-operative support of the Admiralty, War Office and Air Ministry who welcome its introduction as a solution to the problem of the long time previously taken by ordinary letters to and from this theatre of war.


AIRGRAPH
Dear Cham, Thank you for your letter and also the parcel. Glad to hear that some of my pals are doing well. I was not surprised at Nobby getting the Military Medal I should at be surprised to hear that he had won the V.C. life out here is not bad - a bit hot you know Still we are having a grand time I don't know how long it will be before this job is on, but I shall be glad to see the Arsenal once again. Well, that is all this time,
Cheerio. from your old pal. Sid
MR SAM BROWNE
22 ERRIDGE ROAD
LONDON. S.W.19
ENGLAND

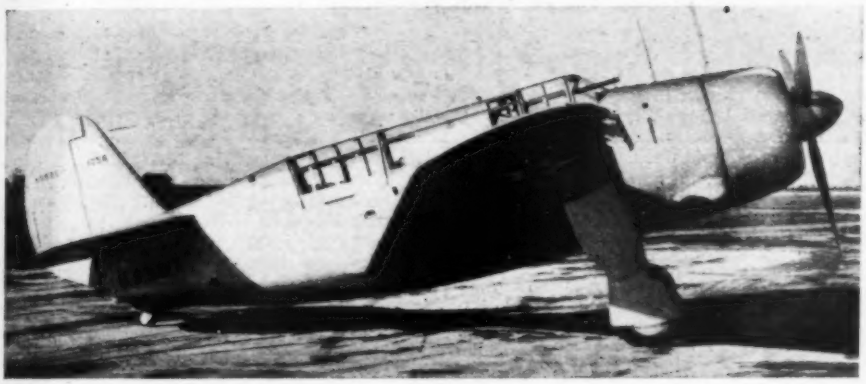
This picture shows the comparative sizes of the original letter and the recipient's copy in relation to the film negative actually sent by air.

LATEST CURTISS DIVE-BOMBER

U.S. Navy Shipboard Weapon is Fast Two-seater : Bombs Stowed Internally



The Curtiss XSB2C-1 Navy dive-bomber looks well suited for its purpose. Cooling gills round the upper half only of the cowling, faired exhausts and the telescopic sight will be noticed. Bombs are carried internally.



COMPLETION of a newly designed Curtiss dive-bomber for the U.S. Navy which the company claims transports a larger bomb load at higher speed for greater distances than any dive-bomber ever developed in America or abroad, and which will greatly extend the striking power of the Navy's battle fleet, has been announced by the Curtiss-Wright Corporation.

The new dive-bomber is designated the Curtiss XSB2C-1 (SB for scout-bomber), and is a two-place, all-metal, low-mid-wing monoplane designed at the Buffalo factory. Designed to operate from aircraft-carriers on extended scouting and bombing missions, it has a 1,700 h.p. Wright Cyclone engine which marks it as the most powerful dive-bomber ever built, and which assures it exceptional reserve of power and range. It is equipped with a three-bladed Curtiss electric airscrew of 25 deg. pitch range from 27.5 to 52.5 deg.

Hydraulic Controls

Details of its armament and performance have not been revealed, but it was designed in response to a request by the U.S. Navy for a dive-bomber that could carry twice as many heavy bombs as any existing dive-bomber, fly twice as far as present models to protect America and its fleet 600 miles farther than previously, remain in flight 4½ hours longer, attain a maximum speed of 100 m.p.h. faster than current types, and mount double the armament.

The Curtiss XSB2C-1 incorporates several desirable features, including provision for carrying the bomb load inside instead of outside the fuselage, thus eliminating drag, wings that fold upward to better facilitate storage on board ship, wing slots that aid lateral control at the low speeds used in landing on an aircraft-carrier deck, and major controls that operate hydraulically instead of mechanically. This dive-bomber is somewhat larger than existing single-engine combat types, including the present Curtiss SBC-4 dive-bomber type used by the U.S. Navy, and is said to have a faster take-off than present-day pursuit craft. It has been designed for rapid quantity production and will be built at the Corporation's mammoth factory of

A three-bladed Curtiss electric airscrew absorbs the 1,700 h.p. from the Wright Cyclone. In the test pilot's hand is the message pad which straps to his right leg; the instrument on his left leg is probably a sensitive altimeter.

CURTIS DIVE BOMBER (Continued)

1,156,000 sq. ft. now being erected at Columbus, Ohio, to employ 12,000 workers. Two other large new factories for the Corporation are also being constructed at Buffalo and St. Louis.

Aircraft designers of Curtiss-Wright Corporation—which incidentally developed for the U.S. Navy its first dive-bomber type, known as the Curtiss Hell-diver, as early as 1930—point out that it was this arm which pioneered the technique of dive-bombing now practised in other countries.

It was for the Germans to perceive the full military value of dive-bombing over land, both as a means of delivering an aerial attack on an objective from a low altitude and as an air arm used in conjunction with mechanised and armoured ground troops. Their Ju 87 Stukas have been successful in these types of manœuvres though at very great cost when met by any resistance. In this country it was the Hart squadrons which worked on the technique for the Royal Air Force in the early 1930s, but as yet Britain has no real dive bomber.

ATLANTIC ADVENTURE

Perilous Moments in a Catalina When "George" Jammed

ONE of the greatest epics of flying is provided by the feat of Flt. Lt. J. G. Fleming, D.F.C., and F/O. J. J. Meikle, two Canadians who joined the R.A.F., in bringing one of the famous Consolidated Catalina flying-boats from Bermuda to Britain. The Catalina carried a crew of six including, besides the two pilots, two flight engineers loaned by the Fleet Air Arm and two Canadian civilian radio operators.

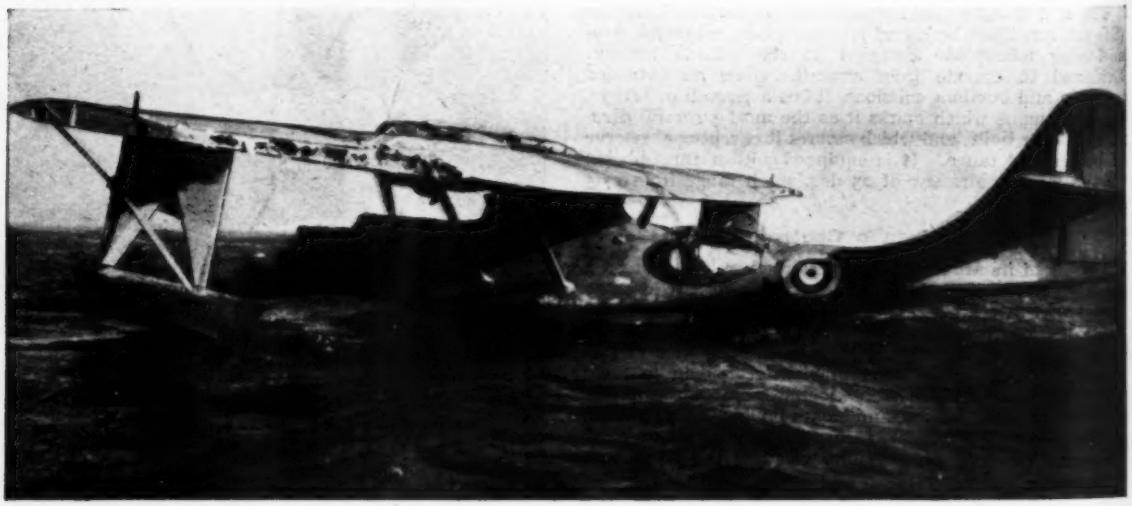
The journey started in perfect weather conditions. Suddenly, when flying at a height of 18,500ft., the automatic pilot jammed. At this critical moment the starboard aileron was full down. The effect was to throw the machine into a spiral dive. Immediately the ailerons began to flutter because of the steep angle at which they were meeting the flow of air. The machine spun from 18,500ft. to only 800ft. above sea-level. During this staggering dive the pilots did their utmost to regain the stability of the aircraft.

Pressure on the ailerons, however, due to the high speed, was so great that one of them broke away completely. This was the worst moment for the pilots. When the second aileron also broke away they found that it helped to restore the balance of the ship, but nevertheless the plight of Fleming and his heroic crew seemed desperate. In their efforts to regain control they found it necessary to jettison smoke flares, spares and tool kit. Included in the tool kit was a £40 outfit, the personal property of one of the flight-engineers.

Just when everyone believed that the Catalina must hit the water, the pilots recovered control. Although they were six hours distant from home, the Captain, confident of his ability now to reach the coast, refused to send out an SOS. Instead, he simply signalled "Both ailerons gone." The signal was received but no one believed it. It seemed impossible that a great machine like the Catalina could still be flying without any lateral control.

The machine was now flying due south. To remain airborne without lateral control it is necessary to turn very cautiously, as use of the rudder without ailerons is liable to put the machine into the fatal flat spin. Fortunately, Fleming managed to turn the machine very gently until it was on its correct course again.

Only fortitude and endurance enabled the pilots to carry on. To add to their troubles, as they approached the British coast they flew into a storm. Despite this, however, they succeeded in safely landing on the water of a British harbour. But they had still some miles to taxi and the sea was rough. This amazing pair, fearing that taxi-ing on the waves would make themselves and the rest of the crew seasick, actually took off again and flew, skimming just above the surface, three miles nearer to their moorings.



HAPPY LANDING: Here is the Consolidated Catalina, photographed after being safely brought into port in a British harbour in spite of losing both ailerons in mid-atlantic as described above.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE King has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. J. ELLIS, D.F.C., No. 610 Squadron.—This officer has commanded the squadron since July, 1940, and his personal example and tremendous energy have been mainly responsible for the high state of operational efficiency. The squadron has destroyed at least 89 hostile aircraft, 11 of which have been shot down by Sqn. Ldr. Ellis.

P/O. R. P. STEVENS, D.F.C., R.A.F.V.R., No. 151 Squadron.—This officer has done particularly outstanding work with his squadron on night operations and has on three occasions shot down two enemy aircraft in one night. P/O. Stevens shows a great determination to attack the enemy, and is prepared to fly under the most difficult weather conditions. His courage, determination, thoroughness and skill have set an excellent example to his unit.

DISTINGUISHED FLYING CROSS.

P/O. G. R. ROSS, R.A.F.V.R., No. 44 Squadron.

P/O. R. WAREING, R.A.F.V.R., No. 106 Squadron.—One night in April, 1941, this officer was captain of an aircraft detailed to carry out a low level attack on two enemy battle cruisers at Brest. When making his attack, P/O. Wareing came down to 1,000 feet, but owing to the darkness he was short of his target. He was met by a terrific anti-aircraft barrage and searchlights. Despite this, he pressed on, but was unable to identify his target. Undaunted, however, he decided to make another attack and, regaining height, flew over the target area for about 40 minutes and finally made a successful attack on one of the ships, dropping an extremely heavy bomb which was seen to burst either on the ship or on the dockside. This officer displayed great coolness and courage in the face of tremendous opposition.

Flight Lieutenant Keith Fergus ARNOLD.

Flight Lieutenant Malcolm Robert MACARTHUR, R.A.F.V.R., No. 236 Squadron.

Act. Flight Lieutenant Barry Thomson AIKMAN, R.A.F.O., No. 210 Squadron.

Act. Flight Lieutenant John Royds ARMITSTEAD, No. 204 Squadron.

Pilot Officer John Henry Nassau MOLESWORTH, R.A.F.V.R., No. 77 Squadron.

Pilot Officer Lancelot Dalrymple SANDES (since killed in action), No. 59 Squadron.

Act. Sqn. Ldr. J. P. D. GETHIN, No. 203 Squadron.—This officer carried out low flying machine-gun attacks against two enemy aerodromes, over 350 miles from his base, and was responsible for the destruction of five enemy aircraft and a petrol lorry. In his attack on the second aerodrome he destroyed four aircraft, all of which caught fire. Sqn. Ldr. Gethin has completed many operational missions. He has displayed considerable skill and great tenacity in delivering his attacks.

Flt. Lt. E. T. SMITH, R.A.F.V.R., No. 237 (Rhodesian) Squadron.—This officer has been continuously engaged on operations over a long period. As commander of a detached flight he has displayed considerable tactical resource and efficiency. He has himself participated in 67 operational missions, and has at all times displayed outstanding courage and leadership with a strong determination to seek and harass any target allotted him.

Capt. K. W. DRIVER, No. 1 Squadron, S.A.A.F.—This officer has led his flight on many offensive operations and fighter patrols. On one occasion he became separated from his flight during an engagement, and, on leaving the area, he observed four enemy fighters and immediately engaged them, shooting one down in flames. Two of the enemy aircraft then attacked him, and so severely damaged his aircraft that he was unable to maintain superior speed. By skilful manœuvring, although he was attacked continuously for 15 minutes, he succeeded in evading them and flew his damaged aircraft back to an advanced landing ground and landed safely. He has displayed great courage in his attacks against the enemy, and has destroyed ten of their aircraft in aerial combat, and at least five on the ground.

F/O. P. D. C. THOMAS, No. 223 Squadron.—This officer has been continuously employed as an operational pilot since the outbreak of war with Italy, and has completed some 40 operational flights with marked success. On a recent night patrol he attacked an ammunition train by dive-bombing, and when this had proved successful he continued the attack with incendiary ammunition, eventually setting the train on fire and destroying it. His night raids have been outstanding. He has frequently remained over his target for an hour at a time, dropping his bombs singly and then attacking the ground defences with machine-gun fire. F/O. Thomas has proved himself to be a daring pilot, and has always pressed home his attacks with the greatest determination.

Lt. R. PARE, No. 1 Squadron, S.A.A.F.—In February, 1941, Lt. Pare was detailed with six other aircraft to carry out an attack on the aerodrome at Massawa. On approaching the target he observed an anti-aircraft gun post about to open fire on the leader of the formation. He attacked and silenced this post, but, in doing so, his guns jammed. In spite of this he continued to dive down on other anti-aircraft posts, thus minimising the fire directed against the rest of his formation. Lt. Pare also displayed great courage and determination in the battle of Keren, shooting down four enemy fighters in two air battles within three days.

P/O. W. B. KENNEDY, R.A.F.V.R., 47 Squadron.—One day in March, 1941, this officer was the pilot of an aircraft engaged on a bombing attack on a selected target in the Keren area. At the conclusion of his run over the target he was attacked by two enemy fighters. Incendiary bullets caused petrol from the port main tank to catch fire. As his air gunner was severely wounded he refused to abandon aircraft and succeeded in extinguishing the flames, although a portion of the fittings of the main tank remained smouldering throughout the remainder of the flight. In order to obtain immediate medical assistance for his wounded air gunner, P/O. Kennedy did not attempt to alight at an advanced landing ground, but returned to base, where he successfully accomplished a difficult landing.

Wing Cdr. W. H. KYLE, No. 139 Squadron.—In April, 1941, this officer led an attack against Ijmuiden Iron and Steel Works. In spite of intense anti-aircraft fire and interference from a patrol of Messerschmitt 109s he dropped his bombs on the target from a height of 50 feet.

The enemy fighters followed Wing Cdr. Kyle out to sea, but, by his skilful flying, he forced them to break off the attack. The operation was an outstanding success. He has now completed a number of successful operational missions and his resolute determination and leadership have been largely responsible for the high standard of efficiency in his squadron.

Act. F/O. W. D. BROWN, R.N.Z.A.F., No. 75 (New Zealand) Squadron.—One night in March, 1941, this officer, as rear gunner of an aircraft which was returning from a bombing mission, sighted a Messerschmitt 110 below his aircraft. In spite of the bad visibility he was able to keep the enemy aircraft in sight. After a few minutes it climbed to the attack, but by excellent judgment and marksmanship F/O. Brown fired three short bursts and the enemy fighter was seen to dive straight into the sea. On a previous occasion when he identified an approaching aircraft as hostile his instructions to the captain enabled him to manœuvre his aircraft so as to avoid the enemy fire, F/O. Brown then used his fire to drive off the enemy aircraft which left in a damaged condition.

P/O. W. M. DIXON, R.A.F.V.R., No. 99 Squadron.—One night in April, 1941, this officer took part in a raid on enemy warships at Brest. Locating his target by the light of his own flare he put his aircraft into a steep dive and at 1,000 feet released his bombs, which were seen to straddle one of the warships. P/O. Dixon continued his dive to 50 feet and, as he flattened out across the harbour, he suddenly encountered intense fire from the multiple guns of another warship lying across his course. He successfully machine-gunned this ship. This officer has shown the most praiseworthy courage and determination, and is an exceptional pilot and captain of aircraft.

DISTINGUISHED FLYING MEDAL.

Sgt. W. MORGAN.—In April, 1941, this airman carried out a reconnaissance over Genoa and Spezia. Although visibility was difficult owing to cloud, Sgt. Morgan, by his accurate navigation, completed his task successfully and obtained valuable results. On the return journey, his fuel became almost exhausted, but he refused to abandon his aircraft and succeeded in reaching his base, where he landed safely. He has completed numerous operational missions and has set a splendid example to his fellow pilots on all occasions.

Sgt. R. PURNELL, R.A.F.V.R., No. 106 Squadron.—One night in April, 1941, this airman was the navigator of an aircraft detailed to carry out a low level attack on two enemy battle cruisers

NORTHERN IRELAND VISIT: The Duke and Duchess of Gloucester at an aerodrome in Northern Ireland. The group includes Lt. Gen. Sir Henry Pownall, Air Comdre. C. R. Carr and Rear Admiral King.

FIGHTER PILOT: Flt. Lt. J. C. Dundas, D.F.C. and Bar, A.A.F., who shot down the German pilot Helmouth Wieck during an air battle last November. Flt. Lt. Dundas was himself killed shortly afterwards.

SERVICE AVIATION (Continued)

at Brest. When approaching the target at a height of only 150 feet, a shell burst in the bomb aimer's cockpit wounding Sgt. Purnell in both legs. Despite the loss of blood and although suffering great pain, Sgt. Purnell insisted on continuing his duties and successfully navigated his aircraft back to this country. Navigation was difficult and two diversions due to thick mist were necessary, before a suitable aerodrome was reached. He displayed great fortitude and a fine sense of duty throughout.

Sgt. K. I. STREET, R.N.Z.A.F., No. 44 Squadron.

In April, 1941, P/O. Ross and Sgt. Street were captain and rear gunner respectively of an aircraft detailed to carry out an attack upon two enemy battle cruisers at Brest. Flying over the target area at a low altitude, P/O. Ross finally located his objective and, in the face of intense and concentrated anti-aircraft fire and searchlights, descended to 1,000 feet scoring a direct hit on one of the ships with an extremely heavy bomb. During the attack Sgt. Street coolly directed his machine gun fire against searchlights and succeeded in extinguishing many of them, thus assisting his captain greatly during a hazardous part of the attack. P/O. Ross and Sgt. Street have completed numerous operational missions and both have, on all occasions, displayed great keenness, courage and determination in pressing home their attacks.

Sergeant Linford Herbert ADAMS, R.A.F.V.R., No. 50 Squadron.

Sergeant Arthur John GARWELL, R.A.F.V.R., No 83 Squadron.

Sergeant Frederick NICKSON, R.A.F.V.R., No. 77 Squadron.

Sergeant James Joseph O'BRIEN, No. 77 Squadron.

Sergeant R. C. WILLIAMSON, No. 210 Squadron.

Sgt. B. E. DYE, No. 219 Squadron.—This airman has performed excellent work throughout the numerous day and night operational flights in which he has participated. He has assisted in the destruction of at least three enemy aircraft and has displayed great keenness and enthusiasm.

Sgt. S. J. FAIRWEATHER, No. 151 Squadron.—One night in April, 1941, this airman was the air gunner of an aircraft which attacked an enemy raider over this country. By his skilful use of the turret and his accurate shooting he damaged the enemy aircraft and finally shot it down in flames. The following night he destroyed another hostile aircraft. He has displayed great keenness and determination.

Sgt. T. MCPHEE, R.A.F.V.R. No. 139 Squadron.—In April, 1941, this pilot was detailed to participate in an attack on a target in Ijmuiden. In spite of intense anti-aircraft opposition which forced his leader to take violent evasive action, Sgt. McPhee kept close company with his leader so that both were successful in bombing the target from a height of only 50 feet. On leaving the target area Sgt. McPhee was attacked by enemy fighters, who followed him for a considerable distance across the North Sea. Although his aircraft was damaged, he succeeded in flying back to his base and landing safely. Sgt. McPhee has carried out numerous operational missions and has displayed great courage and determination throughout.

Roll of Honour

Casualty Communiqué No. 67.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. W. C. Aitken, 747920; P/O. S. S. Barnett, 84726; Sgt. N. Birch, 745792; Sgt. G. B. H. Birdsell, 938323; Sgt. W. N. Brindley, 938689; Sgt. P. I. Burrows, 748672; P/O. G. M. Bussy, 88867; Sgt. P. E. G. Cammaerts, 909525; Sgt. H. Y. Chard, 904176; Act. Flt. Lt. D. A. C. Crooks, D.F.C., 40678; Sgt. J. H. R. Dobbins, 973306; Sgt. H. J. Dowling, 754022; Sgt. L. R. Eden, 906009; P/O. L. R. Evans, 42702; Sgt. W. F. E. Gault, 950326; Sgt. F. B. Harwood, D.F.M., 740429; Sgt. B. Hogg, 625425; Sgt. H. Jagger, 751860; Sgt. L. E. Kiddle, 745006; Sgt. A. M. Murray, 970316; Sgt. H. R. Perry, 908796; Act. F/O. G. F. C. Pledger, 79216; Sgt. W. C. Rawkins, 900862; Sgt. L. Soden, 620009; P/O. J. L. Tait, 85278; Act. Flt. Lt. H. N. Tamblyn, D.F.C., 40862; Act. Flt. Lt. R. C. Thompson, 74343; P/O. D. C. Williams, 41230; P/O. R. E. N. E. Wynn, 81375.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. Beazie, 42185; P/O. A. H. Cholmeley, 40988; P/O. R. K. Felstead, 41786; L.A/C. C. J. C. Jones, 525815; Sgt. J. McG. Little, 741292; P/O. T. McK. Mitchell, 44180; Sgt. A. D. Wright, 747992.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. H. T. J. Anderson, 39021; Sgt. R. C. Astbury, 630781; Sgt. R. A. Attfield, 745008; Sgt. J. Baker, 751839; F/O. W. Barrie-Smith, 39179; Cpl. W. J. Bates, 567448; Sgt. H. H. Best, 626342; Sgt. H. Bowers, 743077; Sgt. P. H. J. Budden, 742113; Sgt. T. P. J. Byrne, 755885; P/O. A. W. Clarke, 42485; Sgt. J. C. Clarke, 743056; P/O. W. A. Cooper, 80556; P/O. M. H. Dalzell-McKean, 33538; P/O. J. S. Davies, 39505; Sgt. O. Decham, 971483; F/O. A. C. Dingle, 72148; Sgt. M. A. F. Drewitt, 570399; Sgt. F. Drinkwater, 541979; Sgt. W. L. Dymond, 580059; Sqn. Ldr. D. Y. Feeny, 32076; Act. Sgt. A. Findlay, 749540; Sgt. P. K. Garvey, 741796; Sgt. D. B. Gordon, 740682; Sgt. J. E. Gorwood, D.F.M., 550891; Sgt. D. W. Halton, 748212; A/C.2 T. P. N. Hammond, 625785; Sgt. C. J. Hann, 580541; Sgt. D. S. Harrison, 527017; Sgt. M. Hill, 567598; Sgt. S. D. Hill, 741410; Sgt. R. E. Hollingshead, 966474; Sgt. A. A. Horsfall, 580957; P/O. P. L. N. Hughes, 81069; Flt. Lt. P. S. Joliffe, 33263; Sgt. M. H. Jones, 741975; P/O. J. Littlejohn, 79207; Sgt. W. A. Lofthouse, 751506; Sgt. C. P. Mapplethorpe, 550436; F/O. L. R. G. Mitchell, 70469; P/O. C. J. D. Montogu, D.F.C., 41863; P/O. C. R. Montgomery, 42421; P/O. H. W. Moody, 81046; A/C.1 J. P. Morgan, 626428; Sgt. K. W. Neaverson, 651567; Sgt. A. B. Norfolk, 751127; Sgt. P. P. Norris, 740810; Sgt. E. Ombler, 633791; Act. Flt. Lt. P. D. Parry-Jones, 40012; Act. Sgt. R. T. Penny, 751121; Flt. Lt. A. S. Phillips, D.F.C., 39153; P/O. I. W. Phillips, 33474; Sgt. J. Price, 626267; Act. F/O. B. L. A. Pusey, 77124; A/C.1 G. Reay, 626591; P/O. B. Reynolds, 42528; Sgt. H. Rolls, 615888; F/O. A. T. Rose-Price, 39762; Sgt. G. P. Rowe, 751202; Sgt. D. G. Shepherd, 625253; Sgt. E. W. J. Skinner, 743057; P/O. K. R. K. Smettem, 41877; Sgt. F. D. Smith, 580384; Sgt. S. G. Stuckey, 516338; Sgt. G. H. Taylor, 644396; P/O. M. R. Turnbull, 42915; Sgt. E. V. Turner, 903333; P/O. G. P. Turner, 79576; Sgt. H. E. Tyldesley, 741308; Sgt. G. W. E. Walton, 568459; Sgt. J. A. Waters, 553302; P/O. F. J. Watson, 42945; Sgt. G. N. Wilkes, 751315; L.A/C. J. L. Wilkin, 534598; Sgt. E. A. Will, 580929; Sgt. C. G. McN. Wilson, 51982; Sgt. I. G. Wills, 96916; Sgt. O. M. Yeomans, 741086; Sgt. P. A. Young, 650682; Sgt. L. R. Youngs, 580905.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—P/O. J. C. L. D. Bailey, 74660.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. R. D. Rushton, 652008.

WOUNDED OR INJURED IN ACTION.—Sgt. R. J. Goode, 748304; Sgt. L. L. Hunt, 742530; Sgt. A. R. Kesson, 966236; Sgt. R. M. Kniveton, 971303; Sgt. J. Mann, 741491; Sgt. J. G. E. Munt, 744380; Sgt. E. C. Pryor, 800645; Sgt. R. Purnell, 745857; Sgt. W. Ross, 759030; Sgt. A. W. P. Spears, 565950; Sgt. A. G. Sunderland, 745216; Sgt. D. S. Thompson, 748493.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. P. E. Butler, 751411; Sgt. D. A. German, 654446; Sgt. L. K. Purrott, 967979.

MISSING BELIEVED KILLED IN ACTION.—Sgt. A. L. R. Cook, 748179; Sgt. A. C. Elliott, 754431; P/O. J. J. Robinson, 85669; Act. Flt. Lt. J. A. Siebert, D.F.C., 76155.

PREVIOUSLY REPORTED MISSING, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Act. Sqn. Ldr. A. L. H. Solano, 37511.

PREVIOUSLY REPORTED MISSING, NOW REPORTED MISSING BELIEVED KILLED IN ACTION.—Sgt. A. G. Elder, 754780.

MISSING.—Sgt. P. A. Adams, 901172; Wing Cdr. D. Addenbrooke, 26195; Sgt. G. Allanson, 549662; Sgt. T. R. Alston, 911565; Sgt. A. J. Anthony, 759275; Sgt. C. T. Atkinson, 984792; Sgt. E. E. Blomeley, 745912; F/O. F. M. Boycott, 39963; P/O. W. Brown, 86350; F/O. J. T. Burgess, 41372; Sgt. W. J. Butler, 751883; Sgt. C. Calvert, 629173; P/O. R. McC. Carrapiett, 87026; Sgt. R. F. Cheesman, 742195; Sgt. T. P. O'K. O'K. K. Coady, 914505; Sgt. F. W. Corder, 742769; Sgt. R. E. Cree, 746709; Sgt. W. A. L. Davidson, 749590; Sgt. E. F. Duncombe, 903442; Sgt. J. A. Faill, 635564; Sgt. D. G. Farmer, 621070; P/O. W. J. Fenton, 85286; Sgt. R. Fitzpatrick, 809113; P/O. A. A. Ford, 88662; Sgt. W. A. Foster, 971160; Sgt. J. M. Fothergill, 43715; Sgt. C. A. G. Good, 745898; P/O. W. J. Gourlay, 88221; Sgt. E. A. F. Crunsell, 752233; Flt. Lt. J. Harrington, 39439; Sgt. C. B. Harrison, 748703; Sgt. W. C. Haynes, 936340; F/O. R. L. Hicks, 33542; Sgt. H. G. Hoad, 1280511; Sgt. M. A. Hollinghead, 553797; Sgt. E. J. Holman, 966883; Sgt. G. H. Howard, 755223; Sgt. B. F. R. Hubbard, 751399; P/O. C. F. Jones, 89361; Sgt. E. Keetley, 937434; Sgt. T. H. Knighton, 745273; Sgt. R. G. Lambourne, 759287; Sgt. A. Lee, 759309; P/O. M. W. Lishman, 81934; P/O. L. D. Loasby, 36242; P/O. R. McCosh, 87352; P/O. P. McMillan, 88685; Sgt. T. R. McWalter, 950398; P/O. H. M. Macrossan, 43288; Sgt. F. G. Manning, 755760; P/O. A. W. Martin, 82720; Sgt. A. R. Mason, 631202; Sgt. J. H. Matthews, 810051; Sgt. A. K. Mills, 742274; Sgt. J. Mitchell, 942752; Sgt. W. P. C. Mitchell, 900804; F/O. P. Moller, 42318; Sgt. J. P. Mountney, 940764; Sgt. G. W. R. Nesbitt, 743084; Sgt. R. E. Nichols, 975306; Sgt. K. R. Northwood, 755216; Sgt. J. T. Owen, 610846; Sgt. P. R. Parker, 755738; P/O. A. E. Phillips, 87413; P/O. R. N. Philpott, 87341; Wing Cdr. P. J. Polglase, 29146; Sgt. J. K. Purdon, 745547; P/O. E. W. Reynolds, 84298; Sgt. J. Riley, 635981; P/O. D. A. Rogers, 88235; P/O. J. H. Rowden, 83249; Sgt. G. E. Salisbury, 751754; P/O. K. F. Seager, 85289; Sgt. J. S. C. Sherman, 942020; Sgt. D. B. Smith, 963117; Sgt. P. A. Sobey, 904838; Sgt. F. H. Sykes, 754947; P/O. S. A. Taylor, 85695; Sgt. C. M. Thompson, 967101; Sgt. H. J. Tomkins, 755975; Sgt. D. C. P. Vane, 910499; Sgt. A. J. White, 745867; Sgt. F. R. Worthington, 654174; Sgt. A. C. Wroath, 904837.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—Sgt. D. Beaman, 542557; Sgt. D. U. Draper, 748687; Sqn. Ldr. C. D. Hackett, 33165; Sgt. J. A. Simpson, 905175.

KILLED ON ACTIVE SERVICE.—Act. Flt. Lt. Lord Auckland, 74387; L.A/C. G. A. S. Blake, 1259650; P/O. P. H. Blake, 88677; Flt. Lt. D. G. Boehm, 39453; F/O. J. Brewster, 90995; P/O. M. F. Briggs, 86346; L.A/C. A. H. Challen, 906477; Sgt. A. J. Cheetham, 964251; Sgt. J. B. Clarke, 639565; P/O. J. A. G. Cornelius-Wheeler, 61495; Sgt. W. Curry, 945257; A/C.1 A. P. Dale, 955632; Sgt. E. R. Devereux, 1164981; Sgt. D G. Fawcett, 969534; Sgt. V. D. Gee, 742767; Sgt. P. Green, 530614; Sgt. A. B. A. Henderson, 550182; Flt. Sgt. G. M. C. Hipkin, 223906; L.A/C. D. C. Hopkins, 1168888; L.A/C. L. R. Horie, 922101; L.A/C. H. Jackson, 968607; A/C.2 J. Jamieson, 1354654; L.A/C. C. A. Kelloway, 798564; Sgt. K. G. Lee, 642748; A/C.1 K. W. Leonard, 552254; F/O. J. Mansel-Lewis, 42248; Sgt. H. L. Maxwell, 748582; Sgt. R. J. R. May, 1325102; L.A/C. W. H. P. Morey, 247689; A/C.1 G. R. Purvis, 1264334; Sgt. A. J. Roberts, 745524; Sgt. D. F. Roberts, 965482; Act. Sqn. Ldr. S. A. F. Robertson, 39259; Cpl. J. Rowan, 522932; L.A/C. J. W. Savage, 1109070; Sgt. J. Scott, 748501; F/O. J. W. Seddon, 74711; Sgt. E. V. Seymour, 526601; Sgt. G. M. Short, 567767; L.A/C. R. E. H. Smith, 520580; L.A/C. K. V. Stean, 930647; L.A/C. G. N. Stickland, 1285169; Sgt. D. Stockton, 1164188; Sgt. T. A. Veasey, 742268; L.A/C. D. M. Wesley, 1376243; P/O. H. A. Williams, 87856; Flt. Lt. D. F. J. Willis, 39591.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.1 W. A. Ayres, 610542; Sgt. R. Heseltine, 563144; Sgt. R. J. Tompkins, 565827; Sgt. O. J. Weeks, 370398.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. M. Beattie, 619827; Sgt. J. Brooke, 745995; Sgt. R. H. Cowley, 580643; P/O. A. C. Denison, 42206; Sgt. C. J. A. Ive, 747985; Sgt. A. Morgan, 651574; P/O. G. C. K. Nolan, 41727; Sgt. R. L. Peacock, 740307; Sgt. E. S. Quinn, 611465; Sgt. F. C. Shook, 581534.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. G. Tock, 741785.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. C. W. Dodge, 507141; A/C.2 R. G. Harding, 1204894; Sgt. A. S. Harker, D.F.M., 740826; A/C.1 D. N. Herbert, 1007211; A/C.2 K. I. Holloway, 1182181; P/O. S. J. Knight, 85037; A/C.1 B. A. Lockett, 1002507; A/C.2 P. W. Lucas, 1120200; L.A/C. J. E. McGorrigan, 1251687; A/C.2 R. F. Pink, 1188139; Sgt. H. C. Stacey, 755302; A/C.2 M. Stapleton, 1021935; L.A/C. H. H. C. Villa, 1176959; Cpl. W. Warrack, 519464.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. F. G. Blake, 812264; L.A/C. G. J. Bleasdale, 508717; A/C.2 J. P. Kruger, 778141; Cpl. V. A. Tompkins, 541779.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 A. Worthington, 539965.

DIED ON ACTIVE SERVICE.—A/C.1 A. E. Bed, 1195191; A/C.2 F. M. Dawson, 1292527; A/C.2 A. Doran, 1212219; A/C.2 W. M. Gow, 1368910; A/C.2 F. R. Haynes, 1180442; A/C.1 J. S. Henderson, 575141; A/C.2 R. B. Miller, 778058; A/C.1 R. W. Morgan, 1009847; A/C.2 A. E. Pace, 955749; A/C.1 J. F. Penlington, 641707; A/C.1 W. J. Prestwich, 1101341; Sgt. T. Robinson, 816103; L.A/C. D. R. Rolf, 1253620; L.A/C. S. Smith, 531465; A/C.2 J. H. Snowball, 1021605; A/C.1 W. H. J. Swinford, 1253624; A/C.1 T. Thomas, 906135; A/C.2 R. A. Thorne, 1199939; L.A/C. D. Turpie, 970163; A/C.2 W. Wilkin, 1028763.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED DIED ON ACTIVE SERVICE.—Sgt. E. P. Corrigan, 580641.

PREVIOUSLY REPORTED MISSING, NOW REPORTED SAFE.—Act. Sgt. E. W. A. Sutton, 759078.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED SAFE.—Cpl. G. A. Battye, 518638; Act. Flt. Lt. N. G. Birks, 39298; Sct. B. M. D'Arcy, 561093; P/O. J. A. Ferguson, 40814; Sgt. A. T. Gay, 565559; Sgt. J. P. Gillhespy, 562127; P/O. P. A. Hunt, 79374; F/O. H. R. Kirk, 70808; Flt. Sgt. H. N. Norris, 565646; Sgt. P. A. Saunders, 516998; P/O. A. G. Sheppard, 78447.

W.A.A.F.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/CW.2 H. Hassett, 424890.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. F. Blatch, N.Z. 401285.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. E. Fuller, A. 39913.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Lt. J. Van de Merwe, 102781.

SERVICE AVIATION (Continued)

London Gazette

Royal Air Force

Air Ministry,
April 25th, 1941.

General Duties Branch.

Flt. Lt. (temp. Sqn. Ldr.) E. A. Whiteley is granted a perm. commn. in substve. rank of Flt. Lt. (Feb. 21).

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—Sergts.: (Mar. 13) D. S. Matthews, D.F.M.; (Mar. 25) F. J. Hogan; (Apr. 2) D. C. Barnett; (Apr. 6) K. J. Bolton.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 21) H. G. Batten, A. G. Cork; (Mar. 1) M. S. Blyth; (Mar. 7) M. W. Coombes, A. A. J. Sanders, A. F. Fegen; (Apr. 1) S. R. Jeffery, A. James; (Apr. 20) B. A. Davidson.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Oct. 4, 1940) S. F. Cole (ret.); (Jan. 4) P. H. M. Richey, D.F.C.; (Jan. 31) C. P. N. Brett; (Feb. 6) O. R. W. Hammerbeck; (Feb. 12) J. K. Collins, T. M. Horgan, D.F.C., D. A. E. Jones, A. M. Ross, W. H. Shaw, A. C. Stewart, R. B. Whittington; (Feb. 16) D. K. Bednall, F. E. G. Hayter, A. I. H. Lynch, D.F.C., H. J. Starrett; (Feb. 18) P. G. D. Farr; (Feb. 24) D. Carlson, R. T. P. Davidson; (Mar. 3) I. MacLeod-Selkirk; (Mar. 18) G. S. Richardson; (Mar. 20) G. Howden; (Mar. 23) R. W. Reynolds, D.F.C., J. A. Siebert, D.F.C.; (Mar. 24) K. F. Vare; (Mar. 31) J. P. Thompson; (Apr. 7) G. O. Lister; (Apr. 9) R. A. Couchman; (Apr. 23) L. D. Wood.

The follg. P/Os. are promoted to war substve. rank of F/O.:—(Jan. 31) W. G. Mellor; (Feb. 1) I. H. Kingwell; (Feb. 4) A. J. Hereford; (Feb. 18) E. G. Dean, G. H. Green, D. C. Pascall; (Feb. 20) S. Ault, J. Barker, L. L. Bartley, L. W. Basan, J. Beveridge, J. D. W. H. Clutterbuck, A. G. Crockett, J. L. Groves, A. N. W. Johnstone, N. M. H. Knowles, R. H. McDonald, T. S. F. Meadows, P. Morris, P. D. Strong, A. Tofield; (Feb. 24) D. Welply; (Feb. 28) G. E. Goodman, D.F.C., O. E. Lamb, B. P. Legge; (Mar. 2) H. D. Van der Linden; (Mar. 4) A. W. McCandlish, D. P. Tuppen; (Mar. 7) A. L. Davis (Lt., R.E., T.A.), P. B. Hall (2nd Lt., D. of W.R.), M. Jubb (2nd Lt., R.E., T.A.), D. G. Redman (Lt., R. Tank R.), J. D. Thirlwell (2nd Lt., R.E., T.A.), J. A. Edwards (2nd Lt., Welch R., T.A.); (Apr. 6) G. Bunce; (Apr. 13) C. W. Miller, P. B. Robinson, D.F.C., C. K. Saxelby, H. D. Newman; (Apr. 17) J. S. Shorthouse; (Apr. 20) W. H. Culling, J. H. C. Lewis, R. M. Pugh, P. Windham.

The follg. P/Os. on probn. are promoted to rank of F/O. on probn.:—(Mar. 1) A. Scott, A.F.C., R. J. N. MacLachlan.

Air Chief Marshal Sir J. M. Steel, G.C.B., K.B.E., C.M.G. (R.A.F., Ret.), relinquishes at his own request the rank of Air Chief Marshal whilst re-employed with R.A.F., and assumes rank of Air Vice-Marshal (Apr. 15).

The notifn. of Oct. 29, 1940, concerning F/O. D. R. Chance is cancelled.

Technical Branch.

The follg. are granted commns. for duration of hostilities as F/Os. on probn.:—W/Os.: (Mar. 24) C. G. Payne, R. A. P. Pink; (Mar. 25) F. P. Woodcraft; (Mar. 26, Sen. Dec. 4, 1940) A. W. Ray. As P/Os. on probn.: W/Os.: (Mar. 1, Sen. Nov. 19, 1940) T. Bradley; (Mar. 28, Sen. Jan. 3) V. F. Wallace. Flt. Sgt.: (Mar. 23, Sen. Nov. 29, 1940) H. L. Davies. Cpls.: (Mar. 29) A. Boonham; (Apr. 1) A. W. Hayes.

The follg. F/Os. are granted war substve. rank of Flt. Lt.:—(Feb. 6) H. L. Whitlock; (Feb. 28) F. N. Paxman, A.F.M.

The follg. P/O. is granted war substve. rank of F/O.:—(Feb. 24) F. T. Arney, A.F.M.

The follg. P/Os. on probn. are promoted to war substve. rank of F/O. on probn.:—(Jan. 12) R. A. Godsell; (Feb. 1) E. Roberts, R. A. Harding, C. A. Fiddick; (Mar. 1) A. P. Lemmon, S. E. Craig, R. F. Corbett.

Administrative and Special Duties Branch.

The follg. are granted commns. for duration of hostilities as F/Os. on probn.:—W/Os.: (Apr. 4) G. C. Moore, H. L. Wade. As Act. P/O. on probn.:—Cpl.: (Apr. 4) J. Billington.

P/O. F. T. Bishop is granted war substve. rank of F/O. (Feb. 28).

The follg. P/Os. on probn. are promoted to war substve. rank of F/O. on probn.:—(Dec. 4, 1940) F. S. Turner; (Jan. 1) W. Lawry, A.F.M.; (Jan. 12) F. J. Rowe; (Mar. 1) A. H. L. Pearce.

F/O. E. V. Stokes is transfd. to Technical Branch (Aug. 11, 1940).

Equipment Branch.

P/O. W. M. Nowell is granted war substve. rank of F/O. (Feb. 16).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

Flt. Lt. S. J. H. Carr, D.F.C., is promoted to rank of Sqn. Ldr. (temp.) (Mar. 1).

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Sept. 3, 1939) S. T. Brown; (Mar. 23) B. L. Price; (Apr. 10) N. Foster-Packer.

Flt. Lt. L. E. Chiswell is transfd. to Administrative and Special Duties Branch (Apr. 15).

Technical Branch.

F/O. S. Herbert is promoted to war substve. rank of Flt. Lt. (Apr. 24, 1940).

Royal Air Force Volunteer Reserve

General Duties Branch.

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—Sergts.: (Mar. 25) R. F. Johnson; (Apr. 1) F. J. E. Stearn; (Apr. 2) H. P. G. Jones; (Apr. 3) D. S. Fuller, R. B. Milburn; (Apr. 4) W. J. Lewis, V. C. O. Maybury; (Apr. 7) V. H. Ekins. Ldg. Aircraftmen: (Dec. 21, 1940) J. A. Lee-Evans; (Dec. 28, 1940) A. G. W. Debonnaire; (Jan. 15) T. M. Channon, K. J. Riddy; (Feb. 28) J. P. Falconer; (Mar. 9) N. B. Daniels; (Mar. 15) A. G. H. Rouse, R. L. Barwick; (Mar. 16) L. D. A. Baron, G. A. Bere, B. C. Curtis, P. J. Edwards, G. C. Frew, W. G. Green; (Mar. 19) K. G. Hemingway; (Mar. 23) P. L. Arnott, D. Bourne, H. P. Duval, J. H. Etherton, R. B. Gilman, W. Hamilton, C. W. C. Henman, D. C. Higson, H. S. Jackson, P. W. Jewell, T. G. Knight, K. E. Knox, D. G. Maxwell, A. G. De B. G. Monk, F. E. Nettleton, G. L. Finlayson; (Apr. 3) J. B. Croucher, M. F. Dear, B. H. Hawken, D. H. Hodgkison, A. C. S. Innes, S. P. L. Johnson, C. H. Secord.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Jan. 14) G. D. Waterer; (Mar. 2) T. N. C. Burrough; (Mar. 7) C. C. Blair, J. C. S. Turner, P. Billyeald; (Mar. 10) D. S. Brown, J. M. Somerville, K. D. Faulkner; (Mar. 24) C. R. Barrett.

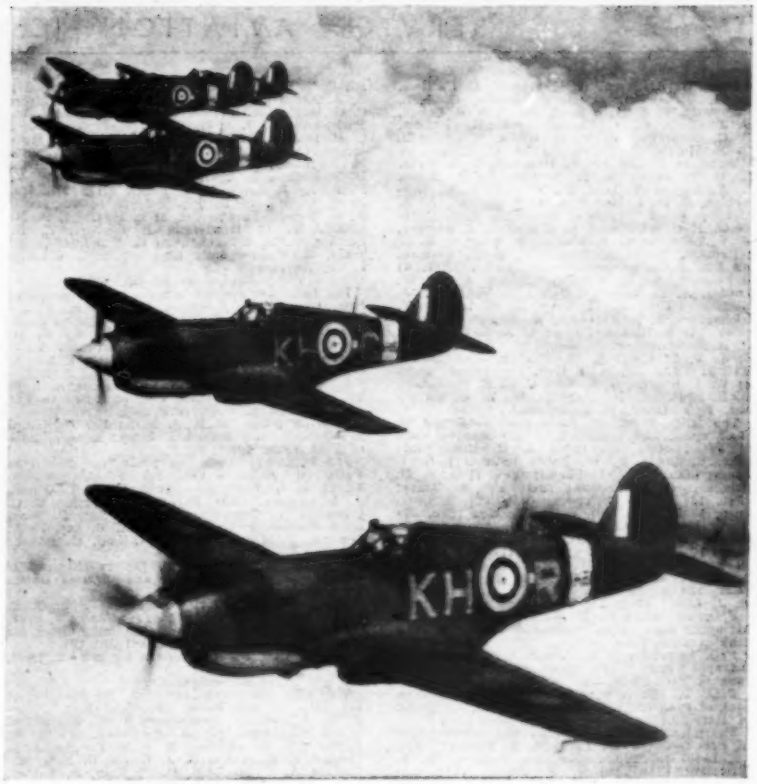
P/O. on probn. J. W. Chubb is confirmed in his appt. (Dec. 30, 1940) and promoted to war substve. rank of F/O. (Feb. 4).

P/O. on probn. L. G. Johnson is confirmed in his appt. (Dec. 30, 1940) and promoted to war substve. rank of F/O. (Mar. 2).

The follg. P/Os. on probn. are confirmed in their appts. (Jan. 13) and promoted to war substve. rank of F/O.:—(Mar. 2) L. Duckworth, C. S. Pyne.

P/O. on probn. A. J. Putt is confirmed in his appt. (Mar. 2) and promoted to war substve. rank of F/O. (Apr. 16).

F/O. I. M. D. Little is promoted to war substve. rank of Flt. Lt. (Apr. 20). (Substd. for notifn. of Apr. 11.)



OUT FOR SCALPS: The Curtiss Tomahawk is now fully operational and flies under the Fighter Command. An Allison liquid-cooled engine of 1,100 h.p. supplies the power.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Nov. 1, 1940, Sen. Sept. 14, 1940) A. P. Craigie; (Apr. 13) L. A. Simpson; (Apr. 20) W. D. B. S. Davie; (Apr. 21) G. E. M. Jones.

P/O. R. J. D. Christie is granted war substve. rank of F/O. (Feb. 8).

P/O. on probn. M. J. Smith is transfd. to Administrative and Special Duties Branch (Apr. 10).

Technical Branch.

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—(Dec. 1, 1940) H. J. Thwaites. Act. W/O.: (Apr. 1) A. S. Prior. Sgt.: (Mar. 24, Sen. Dec. 6, 1940) J. M. S. Watson. As Act. P/Os. on probn.:—(Mar. 28) D. J. Bowen, P. L. Fallon, P. R. Purcell, B. Standing, A. C. Wilkinson, W. Wright; (Apr. 4) N. A. Brampton, G. G. Douglas, H. G. Farish, R. C. Manocha, A. J. Mirchandani, C. N. S. Pringle, L. Ridgway.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 5) J. A. Bradley; (Feb. 8) C. P. J. Gilroy; (Feb. 16) H. L. Bird, V. J. Chipperfield; (Mar. 4) C. T. Chapman; (Mar. 30) I. Croshaw; (Mar. 31) K. B. S. Willder.

P/O. J. H. Bruce resigns his commn. (Apr. 1).

Balloon Branch.

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—Sgt.: (Mar. 28) W. F. Hern. Cpls.: R. J. Callaghan, A. H. Handy; (Apr. 1) J. A. Elliot.

P/O. I. R. Millar is confirmed in his appt. and promoted to war substve. rank of F/O. (Feb. 17).

Administrative and Special Duties Branch.

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—(Nov. 20, 1940) S. Capowe; (Jan. 28) R. L. Squirl; (Feb. 17) C. H. Walter, M.C.; (Feb. 21) C. E. H. Verity; (Feb. 24) H. M. Fisher; (Feb. 26) F. S. Lewis; (Mar. 17) S. E. Penn; (Mar. 23) G. F. Gloster; (Mar. 28) G. C. Brend, F. H. Dobson, G. H. Eldridge, C. C. Fitzgerald, H. E. Hart, G. H. Hollingbery, O. H. Hopgood, A. Mackie, E. E. McCallion, A. Morgan, D. Ogilvie-Grant-Studley-Herbert, H. H. V. Phelps, P. H. Pimlott, S. W. Ratcliffe, N. F. Rigden, W. G. C. Robinson, F. C. Roe, G. Russell-Fisher, J. C. Shepherd, E. C. Spencer, S. C. Spink, R. G. F. Sutton, G. S.-P. Thomas, P. G. Thompson, C. F. Walters, K. R. Webb, E. W. Weekley, C. E. Whitmore; (Mar. 29) G. W. Hodgkinson; (Mar. 31) J. G. Williams; (Apr. 2) L. Hartland, R. E. Thomas; (Apr. 3) W. H. Thompson, M.C.; (Apr. 4) E. B.

SERVICE AVIATION (Continued)

Adams, W. Anderson, H. E. Arnold, E. C. Beer, C. H. C Blount, E. H. G. Brooke, C. McL. Bujnowski, F. J. Bull, R. J. Burry, A. S. Cohen, C. J. Coote, C. M. Danino, T. C. B. de Lom, F. C. Galbraith, H. V. C. Gibbs, W. J. Hall, D. E. Harris, N. Harrow, J. D. C. Harvey, J. Higgins, H. S. Holt, H. S. Hopcraft, C. A. Hyde, E. C. T. Jagot, A. S. Jarman, C. M. Jones, L. A. Lee, S. T. Lord, F. B. Low, R. K. Maclachlan, G. H. J. Margrave, D. M. Medcalf, A. R. Midgley, K. M. Newell, J. Reeve, L. L. S. Rushworth, E. C. Scholefield, A. J. Sington, R. Skipper, G. V. Thomson, C. F. Walker, T. Wheeler, T. G. Wilkinson, R. W. A. Wombwell, R. P. Yattman. As Act. P/Os. on probn.:—Flt. Sgts.: (Apr. 4) R. Carter, S. T. Wibrew. Sgts.: A. G. W. Loader, A. E. Mansell. Cpls.: L. Young, A. J. Glaysher, M.M., H. H. Levy, C. G. Heron, W. Richardson, L. F. Abraham, W. Menzies, L.A/C.: (Mar. 24) A. H. Lowe; (Apr. 4) K. L. O. Jenner, C. E. Robotham, F. W. Goulding. A/C.1: (Apr. 4) J. T. C. Long, A. M. Preston, J. Kendrick. A/C.2: (Mar. 28) S. G. G-S. Underwood; (Apr. 4) W. B. Soames, G. T. Day, C. E. R. Sanderson, D. R. Squier, C. R. Cuthbert, W. W. G. Houghton, T. F. Chew, H. C. Burland.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Oct. 10, 1940) J. H. Rutherford; (Dec. 5, 1940) P. W. Ford; (Jan. 17) R. I. Jones; (Jan. 29) J. L. Shand; (Feb. 7) R. D. H. Osborne, H. A. Shewan; (Feb. 10) A. Baker; (Feb. 16) D. C. Thompson; (Feb. 20) E. Cockburn, M.C.; (Feb. 22) W. A. Becker; (Feb. 27) J. V. Bowring; (Feb. 28) W. C. Adams; (Feb. 29) N. W. Boyce; (Mar. 6) W. L. Blackborn; (Mar. 10) E. G. Barnard; (Mar. 11) W. J. H. W. Shewry; (Mar. 14) A. W. Porter; (Mar. 15) R. G. Burns, E. L. Elric; (Mar. 17) W. J. Daniel; (Mar. 18) R. E. R. Lloyd, J. G. L. Pommerol, A. J. Allcu; (Mar. 21) J. L. Curd, K. Hardie.

P/O. on probn. R. F. Walker is confirmed in his appt. Jan. 13 and promoted to war substve. rank of F/O. (Mar. 9).

P/O. on probn. C. W. Langman is confirmed in his appt. Mar. 9 and promoted to war substve. rank of F/O. (Apr. 20).

P/O. T. Harris is promoted to war substve. rank of F/O. (Sept. 9, 1940). (Substd. for notifn. of Mar. 28.)

The follg. P/Os. are granted war substve. rank of F/O.:—(Sept. 20, 1940) H. E. Blower; (Nov. 15, 1940) L. Miller; (Nov. 20, 1940) C. W. B. Urmston; (Jan. 15) J. P. Orford; (Feb. 13) R. J. F. Burrows; (Feb. 22) J. C. Fitzgerald; (Feb. 25) J. R. Robertson, D.S.O.; (Feb. 26) A. Moore; (Feb. 28) J. Straton-Ferrier, A. A. Reid-Jamieson.

The follg. are transfd. to Technical Branch:—Flt. Lt.: (Apr. 22, 1940) F. J. Knowler. F/Os.: (Apr. 24, 1940) R. H. B. Forster; (Oct. 2, 1940) G. H. Wass. P/Os.: (Aug. 14, 1940) C. H. Jeffreys; (Sept. 17, 1940) E. W. Hindle. P/Os. on probn.: (July 29, 1940) H. C. B. Blythman; (Aug. 20, 1940) I. B. Greig; (Sept. 17, 1940) T. J. Whittaker (since promoted); (Oct. 2, 1940) W. N. S. Bevan; (Oct. 3, 1940) P. B. Burnett; (Oct. 24, 1940) K. A. B. Gillillam; (Oct. 28, 1940) F. J. Bado, L. W. Hancock; (Nov. 11, 1940) T. Vickery; (Nov. 24, 1940) H. F. Blackmore, J. I. I. David, A. P. Dixon, R. Piercy; (Nov. 25, 1940) C. G. L. Scott; (Dec. 16, 1940) R. J. Keir; (Dec. 21, 1940) W. H. Gibson; (Jan. 1) V. Hall, A. R. Hart; (Jan. 9) L. F. C. Turner; (Jan. 12) M. Herniston, J. L. Lutwyche, R. C. Mildner; (Jan. 15) T. D. Martin; (Feb. 2) C. F. Evans, C. H. Frampton; (Feb. 9) P. Heggs; (Feb. 10) M. I. Forsyth-Grant, G. C. Godfrey, D. Hendry, H. S. Hoff, A. Holden, A. Jackson, D. S. Jewell, R. M. Kay, A. Keith; (Feb. 17) H. G. Henderson, T. A. Hislop, J. W. Hunt, E. J. S. Kyte, W. S. White; (Mar. 17) H. F. Howard; (Mar. 30) E. H. Haines, W. T. Sanderson, N. Washington.

P/O. on probn. N. R. Dick is transfd. to Equipment Branch (Mar. 14).

Flt. Lt. A. E. Masters relinquishes his commn. on cessation of duty (Apr. 26).

F/O. T. Bouch resigns his commn. (Apr. 9).

The commns. of the follg. P/Os. on probn. are terminated on cessation of duty:—(Feb. 21) A. C. Dobson; (Mar. 22) A. C. Aspinall; (Apr. 10) A. D Pate; (Apr. 14) H. O. C. Boret.

The notifn. of Mar. 28 concerning J. P. Carlile is cancelled.

Training Branch.

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn.:—(Feb. 1) F. C. Burn, B. K. Cox, A. W. Eccleston, J. Fairclough, H. Farndale, C. R. Forshaw, G. W. Fryatt, A. L. Gregory, E. J. J. Gubbins, F. C. Happold, H. M. Henderson, A. E. Ling, G. B. Littlewood, D. A. Lyons, J. Maw, R. J. Page, F. E. Pease, G. E. A. Pohu, L. V. Russell, F. E. Sharp, W. P. Shaw, E. W. G. Sims, S. Smith, R. C. Spratt, C. E. Swain, C. Trenchard, C. L. Turnbull, H. S. C. Vaughan, W Webb, F. W. Webster, F. Wilkinson, A. Windsor, F. E. Winter, F. H. Wrigley; (Feb. 4) J. H. Peel, G. Shaw; (Feb. 13) W. G. Humphrey, F. W. Wilkinson; (Feb. 15) S. E. Holt, G. A. Hutchings, C. Lord, H. K. Olphin; (Feb. 17) A. B. F. Brown; (Feb. 21) H. W. Marsden; (Feb. 27) I. C. Bendall; (Feb. 28) A. J. Coghill, C. A. Sutcliffe; (Mar. 4) J. Fiddes; (Mar. 5) A. R. Mills; (Mar. 10) R. T. E. Allen; (Mar. 16) R. T. Harry; (Mar. 20) E. G. Lewis, J. G. Morgans; (Mar. 24) K. H. R. Edwards, J. Hulme, W. G. Parsonson; (Mar. 26) A. Wr Macfarlane; (Mar. 27) R. Scurfield; (Mar. 30) E. T. Palmer, C. R. McG. Williams; (Mar. 31) E. J. Armstrong, A. F. Buchan, G. W. Cordrey, C. G. Hayter, A. C. Paterson, L. Robinson, F. W. Turk; (Apr. 1) J. A. H. Brownlow, F. L. Crossley, C. M. Denny, S. Dwyer, H. S. Glover, J. M. Henderson, C. Ramsden; (Apr. 2) J. L. Backhouse, H. J. Bailey, B. D. Barry, H. Brandrick, M.C., H. T. Ebbutt, R. A. Gibbs, T. P. Haddock, W. V. Hunt, A. J. Keen, A. G. Lucas, S. R. Millidge, B. T. Parkin, C. L. Small, J. G. S. Tompkins, K. G. Van-der-Vord; (Apr. 3) L. R. Clegg, R. M. Gould, W. R. Henderson, L. Herbert, E. H. Leather, F. H. O'Donnell, A. C. Radcliffe, G. A. Tiffin, S. Wood-Gaines; (Apr. 4) S. Baxendale, L. A. Knebone.

Equipment Branch.

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn. (Mar. 28):—R. W. Bolton, H. G. Bruce, G. E. Clarke, R. S. Deacon, T. F. Ewbank, P. G. Farley, R. H. Hemmens, H. M. Lewis, H. F. McClune, A. J. McGahey, F. C. Miller, R. J. Pibworth, T. Stapleton, E. S. Taylor, S. R. Taylor, J. L. Westell.

P/O. on probn. T. B. Norgate is confirmed in his appt. (Nov. 21, 1940) and promoted to war substve. rank of F/O. (Feb. 13).

P/O. on probn. D. P. J. Bernard is confirmed in his appt. and promoted to war substve. rank of F/O. (Feb. 19).

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Feb. 22) F. C. Harrison, W. H. R. O'Grady, N. J. Orchard, A. T. Owens, J. A. Lawson; (Mar. 21) R. V. Ashman, E. C. Coysh, A. L. Cunnington, A. J. Frost, P. Gray, F. A. Haime A. R. D. Kitson, A. R. Lee, F. A. London, B. Miller, J. R. P. O'Neill, G. Powell-Harper.

P/O. on probn. R. V. S. D'Arcy Hildyard is transfd. to Administrative and Special Duties Branch (Apr. 10).

The notifn. of Jan. 14 concerning P/O. G. S. de Frettas. *For* Jan. 24, 1940, *read* Jan. 24, 1941.

P/O. on probn B. G. Wootton relinquishes his commn. on account of ill-health (Apr. 19).

F/O. N. H. Lockwood resigns his commn. (Apr. 12).

Accountant Branch.

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn (Mar. 28):—J. R. Alleyne, H. Armstrong, A. C. Broughton, W. L. Chapman, K. J. Couldwell, F. G. M. Edwards, L. W. Edwards, H. E. M. Forman, J. B. Hooper, F. C. Hyatt, H. J. Kemp, D. McC. McCallum, A. P. MacLeod, R. F. Main, A. Mitton, J. C. Monachan, D. C. Standen.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn. (Mar. 29):—I. A. Jones, R. Porter, T. Prentice, C. E. Saunders, A. C. Smith, F. E. Taylor, L. G. Taylor, G. W. Watkins, A. V. Williams, H. E. Wyatt, D. Benoy.

P/O. on probn. V. L. Barrow is transfd. to Administrative and Special Duties Branch (Feb. 26).

Medical Branch.

The follg. are granted commns. for duration of hostilities as F/Os. (Mar. 21):—R. J. L. Ferris, M.B., B.Ch., I. W. H. R. Cran, M.R.C.S., L.R.C.P., R. E. J. Clarke, M.B., B.Ch., J. Burdon-Cooper, L.M.S.S.A., A. J. S. Bell Tawse, M.B., B.Chir., M.R.C.S., L.R.C.P., R. W. S. Marshall, M.B., B.Ch., J. E. McKnight, M.B., B.Ch., W. E. Greenwood, M.B., B.S., M.R.C.S., L.R.C.P., L. H. McGrath, M.B., B.Ch., C. W. Hall, M.R.C.S., L.R.C.P., B. G. Gretton-Watson, M.B., B.Chir., M.R.C.S., L.R.C.P., A. Buchan, M.B., Ch.B., D.R.C.O.G., T. E. Griffiths, M.B., B.S., M.R.C.S., L.R.C.P., C. F. H. Wiessner, M.B., B.Chir., M.R.C.S., L.R.C.P., W. Kirk, RAE, M.R.C.S., L.R.C.P., E. F. Mason, M.B., Ch.B., A. Webb-Jones, M.B., B.S., M.R.C.S., L.R.C.P., A. C. Bingold, M.B., B.S., M.R.C.S., L.R.C.P., L. J. Stoll, M.R.C.S., L.R.C.P.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Feb. 27) O. H. Sennetts, M.R.C.S., L.R.C.P.; (Mar. 5) D. Stevenson, M.B., Ch.B.; (Mar. 12) J. Brown, M.B., Ch.B., W. Goulstone, M.B., B.Ch., M.R.C.S., L.R.C.P.; (Mar. 19) E. I. Davis, M.R.C.S., L.R.C.P., J. O'Brien, L.R.C.P.&S.; (Mar. 26) A. L. Collins, M.B., B.S., M.R.C.S., L.R.C.P., R. F. H. McElligott, M.B., B.Ch., E. G. Patchett, L.R.C.P.&S., L.R.F.P.S., A. E. Ross-Chalmers, L.R.C.P.&S., L.R.F.P.S.

Miss W. H. Redmond, M.R.C.S., L.R.C.P., is promoted to relative rank of Flt. Lt. (Mar. 12).

Errata.

In notfn. of Feb. 28 concerning C. C. Edwards, M.B., B.S., M.R.C.P., D.P.M. *For* F/O. *read* Sqn. Ldr.

In notfn. of Feb 28 concerning E. H. Hudson, M.B., B.Ch., M.R.C.P. *For* F/O. *read* Flt. Lt.

The notfn. of Mar. 28 concerning F/O. A. F. Baldwyn should have appeared under heading R.A.F. instead of R.A.F.V.R.

In notfn. of Mar. 28 concerning J. B. Hine, L.D.S. *For* Jan. 17 *read* Feb. 18.

In notfn. of Mar. 28 concerning H. M. Stewart, L.D.S. *For* Feb. 7 *read* Jan. 7.

In notfn. of Apr. 4. *For* A. E. Ward *read* A. E. Ward, M.D., L.M.C.C., M.C.P.&S.

Dental Branch.

F/O. H. V. Jessop, L.D.S., is promoted to war substve. rank of Flt. Lt. (Oct. 31, 1940).

Auxiliary Air Force

General Duties Branch.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Sept. 3, 1940) J. R. Hawkes; (Dec. 8, 1940) P. B. Robinson.

P/O. H. S. Thomas is promoted to war substve. rank of F/O. (Jan. 11).

Women's Auxiliary Air Force

The follg. are appointed Assist. S/Os.:—(Apr. 12) A/CW.2 A. D. Anderson, Cpl. B. M. Aylmer, A/CW.1 W. M. Bignall, A/CW.1 P. H. Carpenter, A/CW.1 P. F. Cumberlege, A/CW.1 W. A. E. Darley, A/CW.2 D. J. H. Greig, A/CW.2 M. E. A. Herchenroder. A/CW.1 J. M. Kilner. A/CW.1 H. E. Redman, Cpl. M. J. Watts-Russell.

The follg. Assist. S/Os. relinquish their appts.:—(Mar. 2) M. A. Power; (Apr. 6) J. W. Orde. Assist. S/O. U. E. Palmer relinquishes her appt. on ceasing to be employed (Mar. 18).

ARMS AND THE MAN: Lady Jersey dispensing small arms and binoculars given by the American "Arms for the Defence of British Homes" committee. Flt. Lt. T. Rose, of the Home Guard, receives a revolver, but a Tommy Gun would have been more appropriate.